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VOLUME L

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The official publications of THE OTTAWA FIELD-NATURALISTS' CLUB have been issued since 1879. The first were *The Transactions of the Ottawa Field-Naturalists' Club*, 1879-1886, two volumes; the next, *The Ottawa Naturalist*, 1886-1919, thirty-two volumes; and these have been continued by *The Canadian Field-Naturalist* to date. *The Canadian Field-Naturalist* is issued monthly, except for the months of June, July and August. Its scope is the publication of the results of original research in all departments of Natural History.

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The Canadian Field-Naturalist

VOL. L OTTAWA, CANADA, JANUARY, 1936 No. 1

THE BEAVER OF THE RIDING MOUNTAIN, MANITOBA

AN ECOLOGICAL STUDY AND COMMENTARY

By H. U. GREEN

To
Grey Owl,
In Admiration,
I Dedicate the Labour
of this Study.

FOREWORD

THE PURPOSE of a field study is usually twofold:—to increase one's knowledge, and to augment, if possible, the work of other naturalists. There appears at this time, however, when many species of game and fur-bearing animals are fast approaching extinction, the need of including a further design:—to create in the mind of every nature lover a greater aesthetic and economic appreciation of their value to the nation and the necessity for their preservation in reasonable numbers as our heritage to future generations.

"The Beaver of the Riding Mountain, Manitoba", the second of a proposed series of ecological studies covering the larger forms of mammalian life indigenous to the Riding Mountain National Park, could, apart from local comment, well apply to the beaver throughout its North American range, were it not for the fact that certain of its habits deviate in relation to the many diverse environments in which it exists. Therefore, every isolated range differing from another in ecological association presents individual problems which may necessarily change or modify characteristic behaviour in accordance with the demands of the local surroundings. In consequence, the accumulated data must be considered as referring to the beaver of the Riding Mountain, although much, if not all, may be applicable where similar conditions prevail. It is not suggested, though, that extreme deviations from accepted beliefs

Grey Owl

are disclosed, but rather that variations of certain conduct may be evident to investigators whose knowledge has been gained in other parts of Canada and the United States. This I infer from my own experience.

From the spring of 1930 until the autumn of 1932 the work proceeded in conjunction with a study of the Riding Mountain wapiti*. It was pursued during 1933 to the late summer of 1934 as a specific investigation, covering broadly the entire Riding Mountain range. Most of the data, however, were acquired from three beaver families and the locations providing their habitat requirements.

Although every observation was recorded with strict regard to scientific accuracy, many of my deductions from circumstantial facts may be capable of other interpretation. To believe otherwise, in the case of the beaver, would indeed savour of extreme presumption, especially as the study is entirely original and presented without reference to the findings of other authors. I have merely written of what I learnt of this intensely interesting mammal during many delightful months' residence in the wilderness at all seasons of the year, including in the text a brief history and description of the beaver of the Riding Mountain, together with some constructive comment and a series of original photographs from the Riding Mountain range. If the reader derives pleasure and understanding from my efforts, the field work incidental to the study, often performed under adverse conditions, will acquire an added value.

I wish gratefully to acknowledge the financial assistance tendered by the T. Eaton Co. Ltd., Winnipeg, Manitoba, who generously contributed towards the expense of the work performed in 1933 and 1934. I also greatly appreciate the courtesy extended by The Commissioner, National Parks of Canada, for permission to pursue the study, and the interest and kindness of Mr. James Smart, Superintendent, Riding Mountain National Park, and W. A. Scott, Chief Warden. I am further indebted to my good friends, Grey Owl, ex-Constable Mark Goldie, Royal Canadian Mounted Police, and A. Burton Gresham, for their helpful aid.

H. U. GREEN.

Mistamick Lodge,
Dauphin, Manitoba,
December, 1934.

INTRODUCTION

The Riding Mountain may be described as an elevated plateau consisting of some 600,000 acres of forest and bushland rising above the semi open prairies of central Manitoba.

Terminating in steep escarpments cut by deep ravines, and with successive benches indicating the receding shore lines of ancient Lake Agasiz, the northern and eastern boundaries of the "mountain" attain an elevation of 2200 feet above sea level and 900 feet above the plains below. The southern and western borders, however, merge imperceptibly into the surrounding terrain with a gradual loss of altitude. Near the northwest extremity of the plateau a valley, several miles wide at its greatest breadth, separates the Riding Mountain from the Duck Mountain, a range of high hills extending northward for many miles with similar escarpments to the north and east and benches of equal elevation.

Evidence of glaciation is abundant throughout the Riding Mountain area in the form of huge boulders of striated Devonian limestone and other rocks of Cambrian and Precambrian origin from the Canadian shield, besides many lateral and terminal moraines.

The flora and fauna of the Riding Mountain are typical of the border of the Transition and Canadian Life Zones. Dense forests of Black and White Spruce dominate the higher elevations, but here and there destruction by fire has created many extensive stands of Aspen Poplar which shelter solitary bluffs of coniferous survivors and a host of coniferous seedlings seeking an ultimate return to a natural climax.

At the lower elevations, to the south and west, the coniferous forest gives way to Aspen and Balsam Poplar, Box Elder, White Birch, Bur Oak, and Ash, interspersed with small belts of Spruce, Tamarac swamps, marshy meadows, and park-like regions of limited extent.

The original fauna, with the exception of the beaver and several predacious mammals that have become exterminated during recent years, is, generally, well represented.

Few lakes of any size exist, but many small streams rise about the divide at the height of land, creating an extensive watershed draining from the north slope into Lake Dauphin on the plains below the northern escarpment, and from the south into Lake Audy and Clear Lake.

After a winter of average snowfall the watercourses are miniature torrents for several weeks, but unless replenished by spring rains, soon dry up, except in the vicinity of springs and where potholes and beaver ponds exist. Throughout the summer and autumn the watercourses alternately rise and fall in accordance with the frequency and degree of precipitation.

* The Wapiti of the Riding Mountain, Manitoba, by H. U. Green. *Canadian Field-Naturalist*, 47: 105, 122, 150, 172, 1933.

The banks of the larger streams, situated in deep valleys the floors of which are from 100 to 300 yards in width, are, for the most part, heavily wooded with Aspen Poplar between stands of Spruce, offering an unlimited supply of food and building material for beavers.

Some thirty years ago, at the advent of the surrounding agricultural settlement, the Riding Mountain was set aside and administered as a Dominion Forest Reserve. The wild life resources during the major part of this regime were controlled by the government of the Province of Manitoba. In 1930, it was included in the chain of National Parks, under the complete jurisdiction of the federal government. Failing these commendable policies it is safe to say that the Riding Mountain with its forests, scenic beauty, and wild life, would long have ceased to exist as virgin terrain.

Of the three inhabited beaver locations especially under observation, two were situated in the valley of the Vermilion River near its source, approximately one mile east and one mile west respectively of Mile 32 Cabin on the Dauphin — Clear Lake road. The other was situated on a tributary of the Vermilion River known as Spruce Creek, about 200 yards to the west of the Dauphin—Clear Lake road at Mile 35. They are identified and referred to in the text as Sites Nos. 1, 2, and 3. Each location was inhabited by only one family of beavers; an adult male and female and the young of the year.

In referring to the Vermilion as a river, I have been guided by the local topographical terminology, for as such it appears on all maps of the district. However, to apply this designation to the locus of study without explanation would suggest a greater volume of water than actually flows at any season of the year and so create an erroneous impression of the work accomplished by beavers to stem the flow. The Vermilion River at, and near, its source is merely a creek which gains size from many tributaries as it wends a tortuous way from the hills. The width of the river bed above Site No. 1 is approximately 10 feet, and above Site No. 2 approximately 12 feet. Spruce Creek above Site No. 3 is approximately 5 feet wide.

The following air temperature extremes were recorded during the course of the study:—

Summer maximum:	July	102.F
Summer minimum:	July	43.F
Winter maximum:	January	38.F
Winter minimum:	"	minus 46.F

HISTORY

The history of the beaver of the Riding Mountain is the history of all fur-bearers with a price on their pelts existing near the haunts of Man,—a story of willful and illegal destruction bordering on extermination.

A few terse remarks of little value may be gathered from many old residents of the district who speak of previous abundance in the early days of settlement, and reminiscently relate their adventures in the Riding Mountain while poaching the beaver (and other fur) to supplement the meager reward for their initial agricultural activities.

Local Indians, generally a valuable source of information regarding wild life conditions of the past, have little to offer, mainly because of their reluctance in the old days to visit the Riding Mountain, believing it to be the abode of evil spirits. They do say, however, that many beavers once lived there "before the white man came to plough the land".

In themselves such data, although undoubtedly authentic, lack sufficient detail to be of much value. Fortunately, though, the beaver of the Riding Mountain has written its own history; for remains of their work undeniably tell of once wide distribution and probable population, dating back many years before the tide of civilization surrounded the Riding Mountain range, sweeping them almost to oblivion.

Exploring the streams in search of evidence one cannot fail to be impressed by the number and extent of old beaver signs. Innumerable lodges ravished by the flight of time, overgrown with willows and grass, stand tomb-like in the valleys as if sheltering the spirits of the vanished occupants; brush dams broken and bleached by the sun of years streak the now arid flats and meadows where once dense lush grass grew, and countless ranks of beheaded aspens in various stages of decay, but bearing the marks of chiselling teeth, relate a saga of the beaver's passing better than mere words can describe. In a few years little will remain to remind us of the folly of human greed, except a few heaps of crumbling debris. It is well, perhaps, that the sun, wind, and rain, will eradicate an uncherished memory of an inglorious period in the local history of a wonderful animal whose one appreciated value is a coat of glossy fur.

There is indisputable evidence to support the fact that up to forty years ago the beaver population of the Riding Mountain within the area of what now is the National Park exceeded two hundred families, maintained from year

to year through economic trapping by persons from the neighbourhood of old Fort Elphinstone, who, with an eye to the future, practiced methods of conservation disdained to-day wherever beavers exist. Ten years ago a liberal estimate would not account for more than thirty families. During the period of my investigation only eight families could be located, although, without doubt, a few more may have been hidden away in the deep forest. Of this remnant five or six families would appear to be the limit of beaver population in the Riding Mountain National Park, and even they are ever in danger of being destroyed.

It is not strange that persons whose attitude towards furbearing animals is tinged with commercialism should seek to attribute some reason for the decimation of the beaver of the Riding Mountain, other than destruction for monetary gain. Failure of food supply, drought, and disease, are among the suggestions advanced. All are insufficient and merely remote possibilities offered without consideration. My investigation, I believe, proves conclusively that there is not even one circumstantial fact to support these assertions. However, why consider an apologetic explanation when there is sufficient proof to the contrary? The hill billy type of settler with no ideas of conservation or of the æsthetic value of wild life is still responsible for the beaver's destruction as in the early days of settlement. In less degree to be sure, but more devastating in view of ever-decreasing numbers.

CLASSIFICATION AND DESCRIPTION

Common Name:	Beaver; American Beaver.
Local Indian Name:	Ah-meek (Salteaux)
Order:	Rodentia.
Family:	Castoridae.
Genus:	Castor.
Type Species:	*Castor c. canadensis* Kuhl.
Type locality:	Hudson's Bay.

The beaver of the Riding Mountain is *Castor canadensis canadensis* Kuhl.

The genus Castor is represented in North America by several species and sub-species whose habitats extend from Newfoundland to Vancouver Island and from the Rio Grande to the Arctic Circle. They differ slightly in size, colour, or cranial characteristics.

The following description, weights and measurements of the beaver of the Riding Mountain were made from three dead adult specimens, two males and one female, three years or more of age, and one male juvenile, also dead, about five months old. Two two-year-old specimens, male and female, collected alive tor restocking purposes while supplying descriptive information regarding sex, colour, etc., could not be weighed or accurately measured under field conditions. The weights and measurements of several small "kittens" were also neglected as I was reluctant to handle them very much. The dead specimens, although not from the locations especially under observation, came from the same region.

Colour of Adults

Upper-parts: Under-fur, rich medium brown, dense, and curly; surface pelage, rich chestnut with dark guard hairs; head and shoulders, slightly brighter than body.

Under-parts: Under-fur, dull medium brown; surface pelage, dull brownish chestnut.

No perceptible difference between male and female.

Colour of Juvenile

The same as the adults only more subdued.

Colour of "Kittens"

Slightly duller than juvenile.

Weight of Adults

Males:	(1)	35.2 lbs.
	(2)	33.6 lbs.
Female:		38.5 lbs

Weight of Juvenile

8.3 lbs.

Measurements

Males:	(1)	T.L. 39"	T.V. 12.8"	H.F. 5.9"
	(2)	T.L. 36"	T.V. 12.6"	H.F. 5.8"
Female:		T.L. 38"	T.V. 12.5"	H.F. 6"
Juvenile:		T.L. 19"	T.V. 6.3"	H.F. 3.8"

Although the beaver, by virtue of dental characteristics is essentially a rodent, it differs sufficiently from other members of the order Rodentia to warrant a detailed description of certain parts of its anatomy to understand better their use in adaption to a specialized existence.

TEETH.—Twenty in number, equally arranged in both upper and lower jaws. The incisors, four in number, long and scalpriform, grow from persistent pulps. Sixteen molar teeth serve to complete the dental arangement. The enamel of the incisors is reddish brown or orange in colour. It is thicker and harder on the anterior

surface so that a sharp edge is preserved by the wearing away of the softer posterior portion, thus producing a constant chisel-shaped crown. The continual growth of the incisors must be compensated by wear to prevent abnormal development. The molars are strong, rough, with the tissues arranged like the molars of the Ungulates for the purpose of reducing vegetable fibre for food. They have no other use. It is the incisor teeth which serve to cut down trees, etc.

The largest incisors taken from the specimens examined measured, along the anterior curves, as follows:

Lower Pair: 91 mm. Exposed portion: 22 mm.
Upper Pair: 67 mm. Exposed portion: 18 mm.

DENTAL FORMULA

I.	C.	P.M.	M.
1-1 / 1-1	0-0 / 0-0	0-0 / 0-0	4-4 / 4-4

LIPS—The lips are well haired and meet behind the incisor teeth, a wise provision of nature to enable the beaver to work under water without inconvenience.

NOSE—Small, but with relatively large nasal cavities equipped with valves which are closed by voluntary muscular action when the animal is submerged.

EYES—Deep brown in colour, and small in comparison with size of body. Iris black or blackish brown. The eyes of very young beavers are much larger in proportion to their size.

EARS—Comparatively small but very conspicuous when the animal is swimming or resting on the water. Internal orifices closed by voluntary muscular action while submerged.

FRONT FEET—The front feet or "hands" are relatively small. They have five digits terminating in claws of medium length, are sparingly haired and devoid of connective tissue. The "hands" are used in typical rodent fashion for digging, etc., and for holding food when eating.

HIND FEET—The hind feet with five digits are webbed and terminate in long nails rather than claws. A peculiarity is the construction of the two inner nails of each foot which, generally speaking, are double and, to a certain extent, opposable. The supernumary to the inner nail is much shorter than the nail proper, and not as hard. The supernumary to the second nail is of almost equal length, but somewhat blunter. Their purpose is undoubtedly to act as implements for combing the fur and, perhaps, to remove parasites from the skin.

TAIL—Horizontally flat and paddle-shaped and composed for the most part of gelatinous tissue rich in fat. The thickest part is close to the body and along the median line, from which it thins out to the extreme end and sides. Both upper and lower surfaces are naked, except near the junction of the body which is densely haired, and covered with transverse rows of small scales, between which grow a few widely separated minute hairs. The colour of the tail is murky grey.

Tail measurements (naked parts only) of specimens examined and approximate number of scale rows is as follows:

	Length	*Ex.Width*	*Ex.Thickness*	*Scale Rows.*
Males				
(1)	9.1"	4 5"	1.4"	78
(2)	8.9"	4.2"	1.2"	75
Female	8.5"	4.6"	1.7"	81
Juvenile	4.2"	2.8"	.8"	76

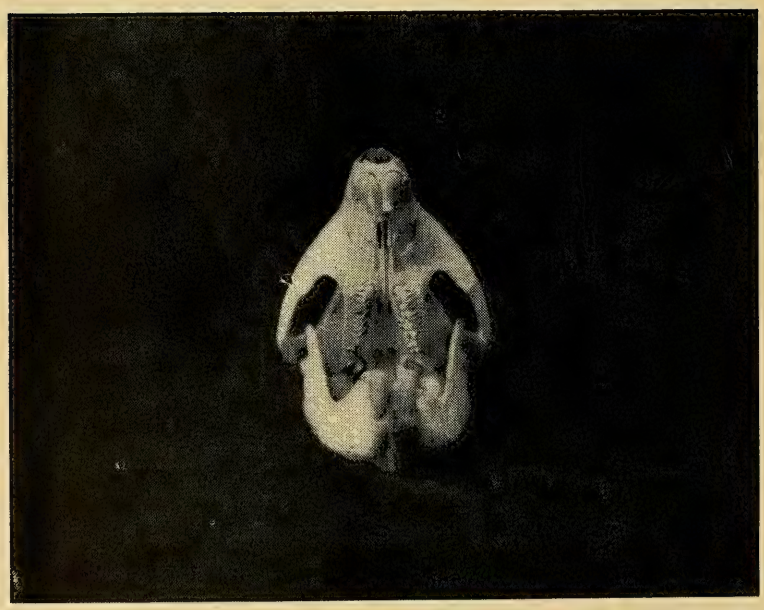
GENITALS—The copulatory and urinary organs of both male and female beavers are not visible externally. Their openings are situated within the anal orifice, which thus becomes a general purpose outlet or cloaca. It is, therefore, difficult upon cursory examination to distinguish one sex from another. However, manual manipulation will cause the penis of the male to protrude, and failing this the testes may be felt by pressure. Determination of sex in the female is without difficulty after the first parturition, for loose mammary glands and elongated teats afford positive evidence.

MAMMARY GLANDS—The female mammary glands with four teats are in the pectoral region, one pair between the fore legs and the other pair a few inches toward the abdomen. The male is endowed with four rudimentary teats or nipples. The teats of virgin females are only slightly larger than those of the male.

ANAL GLANDS—Two pairs of large internal glands are present in the region below the cloacal orifice, one behind the other. The anterior pair, which are the largest, secrete castoreum, and the posterior pair, an unctuous fluid apparently used for oiling and water-proofing the fur. The secretion of the latter oozes through the skin when pressure is applied, and seemingly the only outlet for the fluid is by percolation. On the other hand, castoreum is, I believe, voided per cloaca by voluntary muscular action.

Castoreum has a somewhat musky smell not at all unpleasant to a nose familiar with animal odours. It is oily and, apparently, slightly volatile. The secreting glands are known commercially as beaver castors.

Teeth and skull of beaver. Side view.



Teeth and skull of beaver. Front view.

Photographs by H. U. Green.

Teeth of beaver. Occlusal view, showing condyles and glenoid fossa.
Photograph by H. U. Green.

WALKING; SWIMMING; DIVING

An aquatic mammal in every sense of the word, the beaver is literally out of its element when on land. Progress is slow and cautious, a few ambling steps at a time with body close to the ground, punctuated with a moment's survey of the immediate surroundings before proceeding on its way. The gait is simple, that is the fore legs are followed by the hind legs on opposite sides.

The attitude of the beaver on land is similar to that of all wild things finding themselves for the time being at a disadvantage and helpless to frustrate an attack by prowling enemies. When suddenly disturbed the beavers under observation invariably turned towards the water and, with a galloping gait, ran as fast as their short legs could carry them, reminding one of a lusty woodchuck seeking the sanctuary of its den. This does not mean that walking is a tiresome means of progression, for, as a matter of fact, migration and casual jaunts take them far afield on land.

The beaver's lack of terrestial agility, however, is compensated for by many masterful accomplishments in water, for swimming on the surface or submerged they move with ease and grace at a moderate speed which does not exceed two or three miles per hour. From observation, I should say that the beaver's submerged speed is about equal to progress on the surface.

While swimming, the fore legs are not used, and hug tight to the body out of the way. It is difficult to ascertain positively in what manner the hind legs are utilized, but the evidence is in favour of alternate strokes rather than both legs struck out together.

Change of direction when swimming slowly is, I believe, accomplished by single strokes of either leg applied like the oar of a rowboat according to the direction desired. Turning when swimming in a direct line at top or moderate speeds appears to be performed by rudder-like movements of the tail slightly inclined towards the vertical, the feet being used as an auxiliary. I have never seen the tail employed as a means of propulsion, or any movement which would suggest that it is so used.

The difficulty of making positive assertions in regard to the swimming habits of the beaver is obvious, and it would be interesting to observe the animal in a glass tank of clear water and learn without question how the various movements are performed and the action of the tail as a horizontal plane for controlling ascent, descent, and submerged swimming depth.

Excessive speed is seldom, if ever, necessary in water. Hiding with body submerged and nose above the surface, or seeking the protection of a well concealed den, is more to be desired and infinitely more practical than speeding away in full view of a possible enemy.

Unless otherwise desired, diving is an almost noiseless action, a few bubbles and the concentric circles of small ripples are often the first intimation one has that a beaver has submerged. They seem to slide into the water whether from land, the eaves of their lodges, or some floating log upon which they have been dozing in the sun.

How long can a beaver remain under water without coming to the surface for air? is a question often asked. Two out of many unsuccessful attempts to gain this knowledge throw some light on the subject, but whether or not the beavers were forced to the surface to breath, it is impossible to say. One dived and swam submerged in a direct line towards its lodge breaking surface 58 seconds later. Another, probably the same beaver, as both observations were made at Site No. 1, remained beneath the water for 1 minute and 4 seconds. The indications of each observation were such that there was no doubt the individuals who dived were the same who later re-appeared. It was for want of sufficient evidence to establish identity that many other observations were without value. Sometimes, too, beavers after diving did not re-appear within one's range of vision. They either swam direct to their lodges or dens, or hid among cover about the edge of the ponds. Questionable observations, however, would indicate that beavers may remain under water for from two to four minutes.

A discussion of the swimming and diving ability of beaver "kittens", is reserved for a later chapter.

(*To be continued*)

NOTES ON THE GENUS CYSTIDICOLA IN CANADIAN FISHES

By ELLA EKBAUM

THE MATERIAL upon which the present study is based was obtained from the examination of 170 specimens of different species of Pacific salmon during the months of July and August in 1934. The coho, *Oncorhynchus kisutch* (Walbaum), alone was found to harbour nematodes of the genus *Cystidicola* in the swim-bladder. Out of 63 specimens of coho five were found to be infested with *Cystidicola walkeri* Ekbaum. The degree of infestation was very slight at that time of the year, the highest number of nematodes in one host being four, the lowest two. The fish examined were in their third year.

Specimens of *Cystidicola stigmatura* (Leidy) were collected from whitefish, *Coregonus clupeaformis* Mitch., Lake Winnipeg, Manitoba, in August, 1933, and from ciscoes, *Leucichthys artedi* LeS., Bay of Quinte, Ontario, in December, 1934.

Acknowledgments are due to Dr. W. A. Clemens, the Director of the Pacific Biological Station, and to Dr. G. V. Wilby for much assistance in obtaining the material from Pacific salmon; to Mr. F. J. Fry for the specimens from ciscoes, and to Dr. E. M. Walker for his valuable advice and assistance in preparing the manuscript.

Cystidicola walkeri Ekbaum*

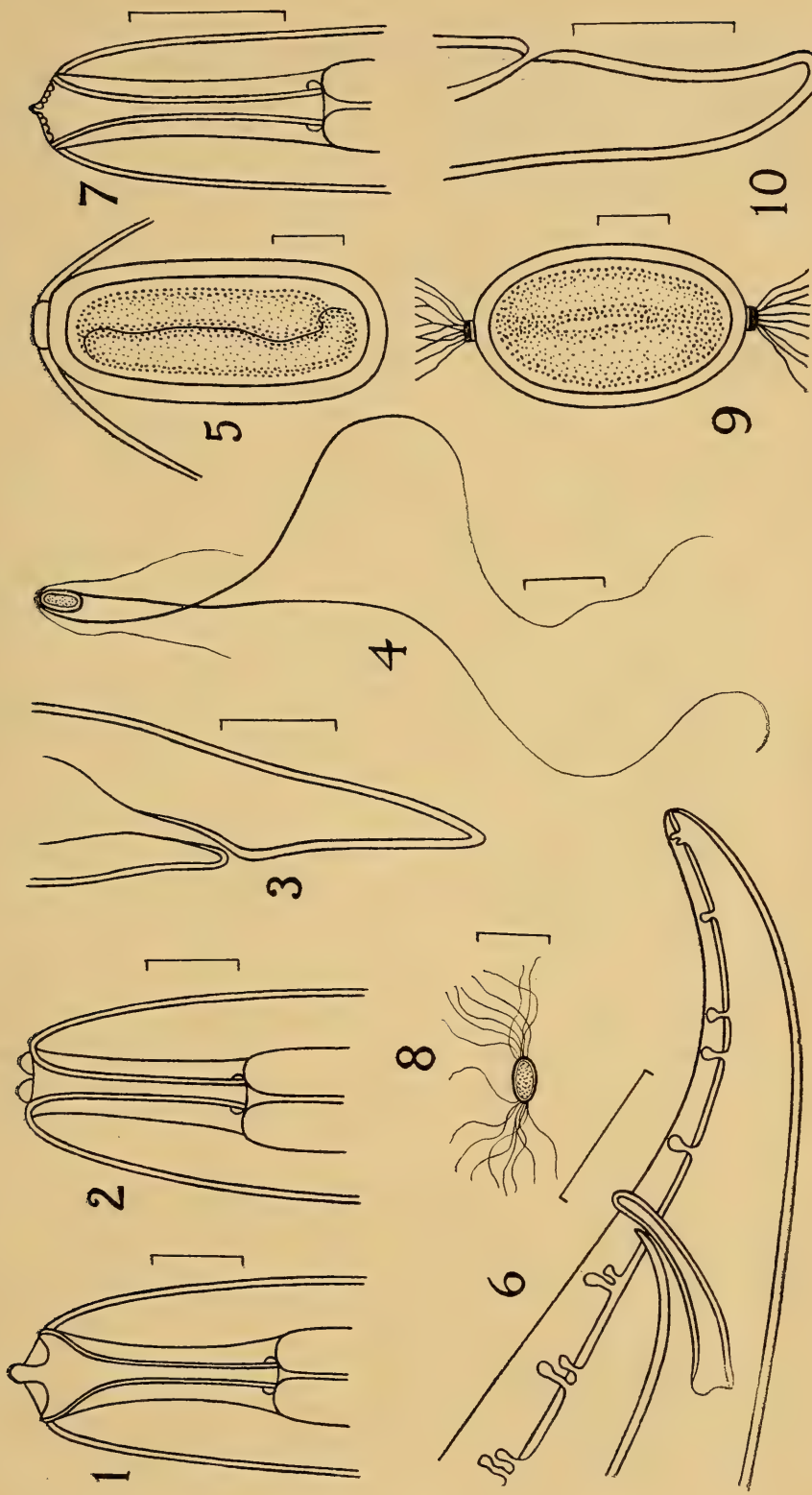
A short note on this new species was published by the writer (1935).

* This species was named in honour of Dr. E. M. Walker, University of Toronto.

Specific diagnosis.—Body comparatively stout, transparent with a smooth unstriated cuticle, tapering slightly towards the anterior end, while the posterior end is more or less sharply pointed. Mouth with two blunt teeth, buccal cavity followed by a cylindrical vestibulum 0.115 mm. to 0.125 mm. in length, 0.013 mm. in width; oesophagus 0 70 mm. in length, 0.09 mm. in minimum width, indistinctly divided into two portions, an anterior muscular part 0.36 mm. long and a posterior glandular part 0.39 mm. long. Nerve ring 0.38 mm. from the anterior end.

Female.—The specimens measured up to 44 mm. in length, 0.82 mm. in maximum diameter; caudal extremity straight and pointed, vulva on the ventral surface, approximately in the middle of the body; eggs oblong with rounded ends and a shell 0.004 mm. in thickness. A cuticular knob at one pole bears two long filaments, about 20 times the length of the egg, which are comparatively thick at the base, but taper gradually to very fine distal ends. Occasionally two very thin and short accessory filaments are present at the same pole. The eggs, 0.046 to 0.052 mm. long, 0.018 to 0.020 mm. wide, resemble those of *Ascarophis morrhuae* v. Beneden, 1870 (in Yorke and Maplestone, 1926), which are also described as having filaments at one pole only.

Male.—The single specimen obtained was 12 mm. long and 0.22 mm. wide; anterior end tapering slightly, posterior end pointed and spirally coiled with narrow caudal alæ; cloaca 0.28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mm. from the tip of the tail; two spicules unequal in length and width, long spicule 0.7 mm. in length and 0.007 mm. in width; short spicule 0.145 mm. in length and 0.023 mm. in diameter at the proximal end, and 0.01 mm. at the distal end; 10 paired preanal papillæ separated by approximately equal intervals; five single postanal papillæ, the second and third being close to each other. There is a small elevation in front of the fifth papilla which gives it an appearance of a double papilla. Type host: *Oncorhynchus kisutch* (Walbaum), in intestine. Locality: Strait of Georgia, immediately outside of Departure Bay, British Columbia.

Cystidicola stigmatura (Leidy)

Synonyms: *Ancyracanthus cystidicola* (Schneider) R., *Filaria stigmatura* Leidy 1886, *Cystidicola canadensis* Skinker, 1930.

This species was first found and reported for Canada by R. R. Wright (1879), in the swim-bladder of *Salmo siscowet* Ag. (*Cristivomer namaycush siscowet* (Agassiz)). He found this nematode in considerable numbers in the host.

Pritchard (1931) found *Cystidicola* sp. numerous in the swim-bladder of four species of ciscoes. His material was described by Mary S. Skinker (1930) as *C. canadensis,* n. sp. but her subsequent studies showed this species to be synonymous with *C. stigmatura.*

The writer was able to examine a considerable number of *Leucichthys artedi,* and fifty-eight per cent. of the fish examined were found to be infested with *C. stigmatura.* In several cases the infestation was very extensive; in one case 480 specimens were counted in one fish.

The main characteristics of this species are as follows: the female up to 55mm. long and 0.5 mm. wide; the male up to 40 mm. long; mouth surrounded by two large and eight small teeth; tail of the female bluntly conical; eggs 0.040 to 0.045 mm. long and 0.020 to 0.028 mm. wide, with a small cuticular knob at each pole, bearing a tuft of very thin filaments, the length of which is usually two to three times that of the egg. Skinker (1931) pointed out that the polar filaments may increase in length with the age of the egg. The eggs of several species of *Cystidicola* were examined by the writer, and it appears that the length of filaments and other characteristics of the egg are of taxonomic value. Specimens of *C. stigmatura* taken from different localities, different hosts and in different seasons showed delicate, short and numerous filaments, unlike those of *C. walkeri,* in which they are long, heavy at the base, and usually two in number.

Cystidicola serrata (Wright)

Synonym: *Ancyracanthus serratus* Wright 1879.

A single female with immature eggs was found by R. R. Wright in the auricle of the heart of *Coregonus albus* LeS. (*Coregonus clupeaformis* Mitch).

The validity of this species has been questioned by some authors, such as Railliet (1916) and Yorke and Maplestone (1926). Pearse rediscovered the species in the intestine of a sheepshead, *Aplodinotus grunniens* Rafinesque, caught in Lake Pepin, Wisconsin, and gave a more detailed description of this nematode. The specific characters, according to Pearse (1924) are as follows: The female measures up to 12.25 mm. in length and 0.051 mm. in width; anterior portion of oesophagus 0.4 mm. long, posterior 2 mm.; mouth surounded by ten conical teeth; the short spicule of the male 0.025 mm. in length and 0.015 mm. in width, the long spicule 0.3 mm. in length and 0.02 mm. in width. The size of the egg is not given but, according to Pearse's figure (1924), it is more broadly elliptical than the egg of *C. stigmatura,* and possesses no filaments at the poles.

This species is included here solely for comparison with *C. stigmatura,* because both may occur in one and the same host.

EXPLANATION OF FIGURES

Cystidicola walkeri Ekbaum

Fig. 1. Lateral view of the female.
Fig. 2. Surface view of female.
Fig. 3. Caudal end of female.
Fig. 4. Egg with two long and two additional short filaments.
Fig. 5. The same in larger scale, showing the shell and cuticular knob with the proximal ends of filaments.
Fig. 6. Caudal end of male.

Cystidicola stigmatura (Leidy)

Fig. 7. Anterior end of female.
Fig. 8. Egg showing a tuft of filaments at each pole.
Fig. 9. The same in larger scale, showing the shell and cuticular knobs with the proximal ends of filaments.
Fig.10. Caudal end of female.

The scale in Figures 5 and 9 has a value of 0.01 mm., in others 0.1 mm. The drawings were made with the aid of a camera lucida.

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57TH ANNUAL MEETING OF THE OTTAWA FIELD-NATURALISTS' CLUB; COUNCIL REPORT

1. MEETINGS.—Three Council Meetings have been held during the year. The President entertained the Council at dinner at Murphy-Gamble's in January. Mr. and Mrs. Hoyes Lloyd and Dr. R. E. DeLury also entertained Council at meetings in their homes.

2. LECTURES.—Through the Lecture Committee, Mr. Ronald Smith and Mr. H. Groh addressed the October and November gatherings respectively, held by the Club in the Carnegie Library. Mr. Smith spoke on "Birds Likely to be Found in the Ottawa District" and Mr. Groh on "Trees".

3. BIRD CENSUS.—The annual bird census is taken in conjunction with other societies in Canada and the United States. The local bird census was taken on December 23rd, 1934, twenty-one observers, in eight separate parties, taking the census. 2,588 individual birds were seen, including fifteen species.

4. EXCURSIONS. — Fourteen excursions were held throughout the year, as follows: February —to the Dominion Observatory, followed by tea at the Orange Lantern Tea Room. March—to Hog's Back, for bird observation. May—four trips—to McKay Lake, Val Tetreau, Fairy Lake, and Britannia. June—to Pink's Lake by O.E.R. bus; to Black Rapids by Dr. McElhinney's launch. July—an evening excursion to the Experimental Farm, for bird observation. September—to Black Rapids, by Dr. McElhinney's boat. October—to Kingsmere, by O.E.R. coach. October 27th—First indoor gathering at the Carnegie Library, addressed by Mr. Ronald Smith. November 23rd—to the Dominion Observatory. November 27th—Carnegie Library — a talk on "Trees" by Mr. H. Groh.

Two meetings of the Committee have been held during the year, at which this programme was drawn up.

At these excursions, various Government publications of particular interest were made available through the courtesy of Mr. Rhoades, Director of Publicity, Department of Agriculture, and Mr. Hoyes Lloyd.

5. REPRESENTATIVE TO MEETINGS OF THE ROYAL SOCIETY OF CANADA.—The President appointed Dr. F. J. Alcock to represent the Club at the meetings of the Royal Society of Canada, held this year in Hamilton, Ontario.

6. INTERNATIONAL COMMITTEE FOR THE PROTECTION OF THE BIRDS OF THE WORLD.—Mr. Lloyd and Dr. Lewis were the Canadian Representatives on the International Committee for the Protection of the Birds of the World.

7. PUBLICATIONS.—Mr. Lloyd, Chairman of the Publications Committee, reports: "The Publications Committee has conducted its duties relating to all publications of the Club throughout the year. The 1935 volume has been completed to the satisfaction of our members. It includes a special number on the Woodcock, which has attracted wide attention.

"In view of the 53rd Stated Meeting of the American Ornithologists' Union being held at the Royal Ontario Museum of Zoology, Toronto, in October, the October number of *The Canadian Field-Naturalist* was made an ornithological number, and copies were given away as samples to the visiting delegates.

"Better arrangements were made for storing the back numbers of our publications, through the courtesy and co-operation of the Department of Mines, which action is helpful and deeply appreciated."

8. FINANCE.—One complete set of *The Canadian Field-Naturalist* has been sold during the year, and another set completed. It is expected that there will be a balance to the credit of the Club at the close of the year.

9. INFORMATION SERVICE.—The Information Service is available to all subscribers. Questions will be answered through *The Naturalist* or by correspondence. The winter indoor gatherings are also being held for this purpose, and any matter for question or discussion at these meetings will be gladly received by the Chairman of the Excursions Committee.

10. SPECIAL AND MEMBERSHIP COMMITTEEES.—No reports have been received from these Committees.

11. FEDERAL WOODLANDS PRESERVATION LEAGUE.—A communication was received from the Federal Woodlands Preservation League, and a letter sent by the Club, expressing its sympathy and interest in the work of the League.

12. ASSOCIATE BOTANICAL EDITOR. — During the year, Mr. John Adams, Division of Botany, Central Experimental Farm, was appointed Associate Botanical Editor.

13. COUNCIL.—It is with pleasure and some satisfaction that we, the members of Council for 1935, review the work of this past year. We wish to express our appreciation of the work and co-operation of many of the members, and hope that the present trend of activities will be maintained throughout the coming year.

M. E. WILSON, *President.* PEGGY WHITEHURST, *Secretary.*

STATEMENT—PUBLICATION FUND
DECEMBER 5, 1935

ASSETS		LIABILITIES	
Canadian Government Bonds	$900.00	NIL—	
Cash in Bank	1.15	Balance	$901.15
	$901.15		$901.15

RECEIPTS		DISBURSEMENTS	
Balance in bank, November 30, 1934	$52.95	Purchase of Bond, 1949—3½%	$102.93
Bond Interest	37.75	Payment of Interest to Current Account	37.75
Bank Interest	1.08	Cash in bank, December 5, 1935	1.15
Life Membership Fee	50 05		
	$141.83		$141.83

WILMOT LLOYD, Treasurer.
December 10, 1935.

Audited and found correct.
December 10, 1935.
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STATEMENT—RESERVE FUND
DECEMBER 5, 1935

ASSETS		LIABILITIES	
Canadian Government Bonds	$1200 00	NIL—	
Cash in Bank, December 5, 1935	193.87	Balance	$1393 87
	$1393.87		$1393 87

RECEIPTS		DISBURSEMENTS	
Balance in Bank, November 30, 1934	$ 138.01	NIL—	
Bond Interest	54.00	Balance in Bank, December 5, 1935	$193.87
Bank Interest	1.86		$193.87
	$193.87		

EDWARD F. G. WHITE, Chairman,
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STATEMENT OF FINANCIAL STANDING
OTTAWA FIELD-NATURALISTS' CLUB, DECEMBER 5, 1935

ASSETS		LIABILITIES	
Balance in Bank, December 5, 1935...	$88.17	NIL—	
Bills receivable.....	74.69	Balance	162.86
	$162.86		$162.86

RECEIPTS		DISBURSEMENTS	
Balance in Bank, November 30, 1934.	$ 116.24	Printing and mailing The Canadian Field-Naturalist.....	$1092.23
Fees—Current.....	814.13	Editor's Honorarium.....	90.00
" —Advance.....	53.15	Postage and Stationery.....	35.70
Single and back numbers.....	196.36	Separates and Illustrations.....	183.29
Separates and Illustrations.....	138.26	Bank discount.....	18.85
Miscellaneous	203.13	Miscellaneous.....	13.03
	$1521.27	Balance in bank, December 5, 1935...	88.17
			$1521.27

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NOTES AND OBSERVATIONS

BEHAVIOUR OF BIRDS IN A GALE IN COASTAL WATERS.—An opportunity to observe some birds in a gale in shore waters came to me on May 5, 1933. The small steamship *Lovat,* on which I was a passenger, spent that day at anchor in the lee of East Point, Prince Edward Island, at the distance of about a mile from shore, while a heavy northwest gale raged. I estimated the velocity of the wind to be from 50 to 55 miles an hour. The temperature was a little above the freezing-point and occasional squalls of snow flew about the ship. Because of the shelter afforded by East Point there were no large waves in the vicinity of our anchorage, but the water there was severely disturbed on a minor scale.

An adult male Northern Slate-coloured Junco (*Junco hyemalis hyemalis*) came aboard the stationary steamship about mid-morning, having presumably been blown away from land to windward. After a brief rest, it tried to fly back to Prince Edward Island, but without success. It took up a position beside the steamer, where it was somewhat sheltered from the strength of the gale, and there it flew for some time, with its head to windward, without making any progress. Twice it tried to alight on the foaming water, but each time it rose quickly again after its feet had apparently touched the water. Finally, it struck out from the shelter of the ship and was at once blown rapidly to leeward. It was not seen again and presumably perished in the wind-lashed waters.

Another sparrow-like bird, which was not specifically identified, was seen near the steamer in the afternoon, when the wind continued to blow with undiminished velocity. It, too, was headed up wind towards Prince Edward Island, but it was unable to make any permanent progress. By keeping down, close to the waves, it repeatedly gained 20 or 30 yards to windward, but then apparently it was raised each time by boisterous air currents to a height of about 30 feet above the sea, when it was at once blown to leeward until it succeeded in getting down close to the water again.

It was also noticed that American Herring Gulls (*Larus argentatus smithsonianus*) resting

on the water near the ship during the gale not only faced to windward but held their heads low on their shoulders, with their bills pointing below the horizontal, thus decreasing their resistance to the wind.—HARRISON F. LEWIS.

RECENT RECORDS FROM KING TOWNSHIP.—The following are all sight records in King Township, York County, Ontario:

LESSER SNOW GOOSE. *Chen hyperborea hyperborea.*—A flock of about 100 of these Geese was seen on October 30, 1934, flying over from the east and going south-west. This is believed to be the first record for the township.

NORTHERN PILEATED WOODPECKER. *Ceophloeus pileatus abieticola.*—A single bird was seen on September 18, 1932, to make the second recent Toronto district record. Single birds were seen again February 12 and April 23, 1933, and two females February 28 the following year. On July 22, 1934, a pair was seen and since then birds singly or in pairs have been seen at fairly frequent intervals.

Numerous other observers have seen Pileateds in this area since the fall of 1932 and it would seem that this interesting bird is re-establishing itself in the Toronto district after an apparent absence of about 40 years.

KINGBIRD. *Tyrannus tyrannus.*—An unusual nesting site for this species was noted July 3, 1934, in the top of a White Pine on the south edge of a bush some 40 feet from the ground.

BLACKBURNIAN WARBLER. *Dendroica fusca.*—Young birds of this species were being fed at the top of a large hemlock in mixed bush on July 15, 1934, and again in pure second growth White Pine bush on July 17th. This is the first evidence of this warbler breeding in Toronto district, though the writer saw adults with young birds on the wing on July 26, 1934.

PINE WARBLER. *Dendroica pinus.*—These warblers were noted feeding young birds on July 17, 1934, in the tops of pines in fairly dense White Pine bush. One bird which flew down just above the observers showed a faint necklace of streaks similar to those on a Canada Warbler. This is believed to be the first definite breeding evidence for Toronto district.

RED-EYED TOWHEE. *Pipilo erythrophthalmus erythrophthalmus.*—On January 16, 1931, while watching a flock of White-winged Crossbills, a solitary Towhee was discovered scratching about in a dense thicket of hemlock. The bird was not seen again.—R. D. USSHER.

NOTICE TO ORNITHOLOGISTS

WHEREAS the 4th edition of the A. O. U. Check-List has been adopted as the standard of ornithological nomenclature for "The Canadian Field-Naturalist," and,

WHEREAS this Check-List does not provide English names for species in cases where species are divided into subspecies, which is considered illogical and highly inconvenient, and which causes a great deal of unnecessary editorial labour, and,

WHEREAS the nomenclature used in Taverner's "Birds of Canada" provides English species names for all species dealt with in it, and provides also a logical pattern of English subspecific names, therefore,

BE IT RESOLVED that the nomenclature of Taverner's "Birds of Canada" be made the standard of ornithological nomenclature for "The Canadian Field-Naturalist," instead of the nomenclature of the 4th edition of the A. O. U. Check-List.

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NOTES ON SOME MAMMALS OF THE CHILCOTIN, BRITISH COLUMBIA

By KENNETH RACEY

LYING BETWEEN the Fraser River and the Coast Range and south of the mainline of the Canadian National Railway is a vast area of range land, jackpine barrens, lakes and mountain known as the Chilcotin. An automobile road runs from Williams Lake to Redstone where, dividing, one branch runs north to Chezacut and the other west to Tatla Lake thence north to Anahim Lake. This country is sparely inhabited and what few ranchers and settlers there are, are having a difficult time to survive in so inhospitable a region. Indians of the Redstone and Blackwater groups still roam through the country and these exist precariously on what fish and game they can take plus some assistance from the Government. Smallpox and tuberculosis have so depleted their numbers that in a few years they will all be gone. Roads are bad except for a short time in midsummer and trails are few and rough. Big game, except the Moose in the more inaccessible parts, is becoming scarcer.

During the summer of 1931 the writer accompanied by his family and Mr. Ian McTaggart Cowan visited the Chilcotin and collected many of the small mammals found from Chezacut Lake to the Itcha Mountains.

Our party of six arrived at Williams Lake on July 22nd, where a supply of provisions was awaiting us. It was late afternoon before we left the town and, when about ten miles out, came on a female Porcupine with a little black youngster, and later after crossing the Fraser River and ascending Sheep Creek Hill we saw two adults and one young Porcupine. These animals scrambled up the steep bank as rapidly as possible to escape the bright glare of the car's headlights. That night camp was made on the open range near Riske Creek and the following morning some collecting was done on the surrounding ranges, where we found but few signs of wild life except Chipmunks (*Eutamias amœnus affinis*), Crows and a few Horned Larks (*Octoris alpestris merrilli*). At Hanceville the skull of a large male Grizzly Bear was secured. This animal had been shot at Big Creek in the nearby mountains.

Beyond Redstone the trail led through parched jackpine-covered hills for many miles. A forest fire was raging about thirty-five miles south of Chezacut and through a corner of this lay our road. Fortunately we came through without mishap and arrived at Chezacut Lake at sundown. Here, at an altitude of 3450 feet our main camp was made.

Chezacut Lake is about three miles in length and varies in width from a few hundred yards to about a mile at the north end. It is a shallow body of water, much weed-grown and contains many acres of lily pads. On the east and northeast sides are extensive wild hay meadows and, where the Chilcotin River flows into the lake, there is a considerable area of dense spruce forest with willow undergrowth much frequented by the Varying Hare (*Lepus americanus columbiensis*). Along the margin of the lake is: heavy growth of aspen, willow, black spruce, jackpine, black birch and a few alder on the west side. A fringe of swamp grass surrounds the lake.

On arrival at Chezacut Lake several white Pelicans were seen fishing not far distant from our camp and later we found that they came daily to the lake to feed. We were informed that considerable numbers of these birds nest on what is known as Pelican Lake about fifty miles distant.

The local Indians were very friendly and curious and paid us many visits and frequently we gave them hard tack covered with marmalade which they ate with much gusto.

A much decayed dugout was found and this, repaired with cotton wool, tin cans and pieces of rag, made a slow but serviceable vessel.

Chezacut Lake proved to be a perfect small mammal collector's paradise and some splendid series were collected.

On August 11th, I left our main party and, with a white packer and an Indian guide, set out with packhorses for the Itcha Mountains distant about seventy-five miles northward. Having heard many strange tales from the Indians about this range I was very anxious to visit and explore it and, if possible, photograph what was said to be the only remaining herd of Caribou in the Chilcotin. For several miles we traversed jackpine clad hills and then followed Newton Creek up into the hills to Horseshoe Creek. Flocks of duck were seen and occasionally a Redbacked Vole or Jumping Mouse was noticed. Horseshoe Creek is in reality a very small creek which has for a considerable distance been made by beaver dams into a series of meadows now all covered with a heavy growth of swamp grass. The old dams and lodges were quite extensive, the former being from six to eight feet in height. All Beaver have been trapped out and the old lodges and ponds are now occupied by numerous Muskrats. We camped at the end of a large meadow and during the night two Moose came close to camp very much frightening the horses. Travelling the following day was difficult; for miles we wended our way through pine and sand barrens, windfalls and burnt-over lands, which the Indians know by the appropriate name of "the country of little sticks". For a mile or two after leaving camp we rode alongside a small valley where our Indian, Lacise Cha, annually sets traps for Lynx. This narrow valley has here and there open meadows alternated with dense growth of black spruce, pine, willow and black birch, the swampy areas being carpeted with sphagnum moss. While watching a bull Moose a heavy thunderstorm with hail and rain came on and we were forced to take refuge in a thick spruce swamp and light a fire for warmth as it was bitterly cold. This swamp was at the end of a very large muskeg where the Indians say the Sandhill Cranes come annually to nest and where Moose are plentiful. Continuing on to Moore's Flats we saw a doe Mule Deer and examined with great interest a natural soda salt lick visited by many Deer and Moose, the ground surrounding the lick being trampled by countless hoofs, with here and there an old shed antler of Caribou or Moose. Moore's Flats is meadowland several miles in extent and is watered by two streams. These flats appear to be an old lake bottom, the water of which had in the dim past broken through a divide and drained into the Chilcotin River. The Indians have a legend of a great flood which came down this river long ago. We camped above "The Falls", so called because it is the only fall on the whole Chilcotin River. These falls are only between fifty and sixty feet in height, but descend in a long slope over rocks for about two hundred feet. Here we saw another Mule Deer which was quite unafraid of us and in the late evening wached a bull Moose feeding in the river just above camp. The altitude at the falls was found to be 4725 feet and during the night there was a heavy frost which left a fringe of ice along the river and froze the water in the camp pails. At this point a Marsh Harrier and a Sparrow Hawk were seen. On the following day we forded the river a mile or two above the falls and continued on the west side. For several hours we rode through a sandy jack-pine waste and here on the sand could be seen countless tracks of moose, deer, coyote, fox, hare, chipmunks, squirrel and mice, the last three animals having well-defined and beaten runways in many places. On the third day we came in sight of the Itcha Mountain Range (Itcha meaning windy or mountain of the wind); these were about ten miles distant and looked wonderfully beautiful in the afternoon sun. The main mountains and some of the surrounding peaks appeared bright red intermingled with patches of snow and masses of grey rock. Following up Caribou Creek which rises in the centre of this range, we crossed about three miles of muskeg, stunted pine clad hills and spruce woods and arrived at the base of the mountains where we camped by the creek at the edge of a dense spruce forest. Four bull Moose were feeding in a nearby meadow. One of these animals was of immense size and on examining the tracks in the soft moss and mud we found that its hoof prints were about a third longer than that of the other bulls. All these animals had well-devloped antlers still in the velvet..

The Itcha Mountains rise from the Chilcotin plateau to an altitude of over eight thousand feet and stand removed from the main Coast Range which can be seen on the western horizon distant some seventy or eighty miles. Except in sheltered valleys and on the lower shoulders there is little vegetation although there are extensive open ranges covered with caribou moss extending for miles in every direction and on the lower levels stunted black birch and mountain sedges appear. The birch-covered upland was the favoured haunt of the Willow Ptarmigan. Several of the mountains in this range are composed almost entirely of red lava and

cinders. Springs in a deep walley in the heart of the range give rise to Caribou Creek and this valley is surrounded by towering peaks and in some places curiously shaped eroded rocks were found on the cliff sides. The only outlet of the valley is towards the south and its floor has a luxuriant growth of grass, black birch, willow and stunted spruce; mountain flowers bloom in profusion along the margin of the creek. Here in suitably situated rockslides are to be found great numbers of Hoary Marmots. The mountains to the north of "Caribou Valley" are masses of barren rock, sand and cinders and their northern slopes are almost devoid of vegetation. On the west side of the range lie several sheltered valleys with good cover and ample food supply and here in abundance are to be found moose, deer, marmots, squirrels, pika, and chipmunks, with ptarmigan on the more open hillsides and the white-tailed ptarmigan above the open rocks and peaks. Still further west is a great expanse of muskeg with spruce forests dotted here and there with grassy meadows and lakes until the distant foothills of the Coast Range are reached. We completely circled the Itcha Mountains on horseback and found the northern slopes extremely barren and rough. On the lower slopes of the southern side of the range are numerous small lakes abounding with cut-throat trout, running from twelve to fourteen inches in length. Some of the lakes are quite landlocked, so that the original stock must have come up Caribou Creek at some period of very high water, when the lakes were overflowing. On our throwing bearberries into one of these lakes dozens of trout would make a rush for the berries as soon as they touched the water, and with improvised flyhooks we were able in half an hour to secure sufficient fish to last two days.

From these mountains one can look for many miles over the vast Chilcotin plateau. To the south-west across muskeg and spruce swamp, Anahim Lake can just be discerned in the distance. To the south and south-east are great areas of muskeg, round-topped hills and patches of forest, the whole interspersed with small lakes and streams and here can be seen the source of the Chilcotin River, which starts as a tiny streamlet from an insignificant spring-fed lake. To the east one looks towards the Blackwater country, over a great expanse of muskeg, lake and forest. The Indians say that all this country is a great breeding ground for swans, geese and duck, but certainly there were none of these birds in evidence while we were in this particular region. In the open uplands it was uncomfortably cold with a piercing wind blowing all the time and unless constantly in motion one was soon thoroughly chilled.

The following is a list of the mammals found to be in the Chilcotin:

Sorex cinereus cinereus Kerr, CINEREOUS SHREW. — The most common form of shrew found. Twenty-two specimens were taken, 12 males and 10 females.

Sorex obscurus obscurus Merriam, DUSKY SHREW. — Five males and five females were secured. Nine of these from Chezacut Lake and one, a female, was caught in the Itcha Mountains. Although traps were out for several days this was the only shrew taken about these mountains.

Microsorex hoyi hoyi (Baird), PIGMY SHREW. — Three of these small mammals were taken in the long grass bordering Chezacut Lake. All three shrews were adult males with the following dimensions:—

No. 623 — 78-27-10.
No. 695 — 81-27-10.
No. 704 — 81-25-10.

Sorex palustris navigator (Baird), ROCKY MOUNTAIN WATER SHREW. — We found these animals fairly common about the lake shore and sixteen specimens were secured. Some of these water shrews were of very large size:

Average of six adult males:
Total length 159.3 (149-173).
Tail vert. 77 (71-82).
Hind foot 20.1 (19-21).

Average of ten females:
Total length 160.5 (150-179).
Tail vert. 76 (69-82).
Hind foot 20 (19-21).

Lasionycteris noctivagans (Le Conte), SILVER-HAIRED BAT. — The most common bat and constantly seen flying about camp and lake shore. Ten specimens were taken, 1 male and 9 females.

A small bat was seen flying about the tree tops one evening when camped by Caribou Creek.

Ursus americanus Pallas, BLACK BEAR. — Old signs were plentiful everywere, but no animals were seen. The Indians told us that these bears would be found in numbers along the Salmon River where they go to feed on salmon.

A very large skull was found in the bush on the hill above our Chezacut camp.

Bear signs were noted in the forest about the base of the Itchas, and one evening when dis-

cussing these with Lacise, he turned to me suddenly and said he would give me two fine large bear skulls which he had preserved at home. On the return journey when approaching his cabin we came on the first skull placed on the trimmed-off top of a pine tree. It appeared to be that of a half-grown animal. Lacise said he would not care to touch this skull as the beast had been killed by his son. Later we found the second skull perched in the same manner on the top of another pine tree. As we passed the Indian bowed his head and said something to the skull and hurriedly went on, not offering to take it down. It appears that these Indians hold the bear in great dread and are afraid that a dead bear's spirit may do them some harm. Before killing a bear they tell the animal how sorry they are to take its life, but when it is dead they make most unkind remarks about the deceased creature. The skulls of bears taken in hunting are always cleaned and placed in a commanding position on the top of a tree which has been trimmed off for the purpose. They believe that the animal's spirit remains in the skull so it is treated with respect. I asked Lacise why they put the skulls on the top of trees and he replied "so he can see big coupntry".

Ursus sp? GRIZZLY BEAR. — None encountered, but both white hunters and Indians say they are to be found westward in the more mountainous regions. The skull of an adult male grizzly was secured. This animal had been shot in the Whitewater district.

Martes americana abietinoides Gray, BRITISH COLUMBIA MARTEN.—Marten are now extremely scarce having been trapped out. A few pelts are still brought in. It is commonly reported that at one time marten were very abundant and especially so in the spruce forests bordering the Itcha Mountains.

Mustela cicognanii richardsoni Bonaparte, RICHARDSON WEASEL. — Common about Chezacut Lake where five males and one female were taken. Another female was secured by Caribou Creek.

Mustela vision energumenos (Bangs), WESTERN MINK. — Mink were very scarce having been heavily trapped during the past few years when prices were high. Three were taken, a male weighing 2½ lb. and two females. All three have very dark summer pelage.

Lutra canadensis canadensis (Schreber), CANADA OTTER.—Very scarce. A freshly used slide was found at the foot of the Chilcotin River falls. This slide was on the side of a very steep bank and was about twenty-five feet in length; it was very smooth and by its side was a well-worth runway which was doubtless used by the animals when climbing back to the top of the slide.

Mephitis hudsonica Richardson, NORTHERN PLAINS SKUNK. — A number of burrows were found near camp and several specimens secured.

One day a squaw came galloping into camp with a sack tied to her saddle, this she handed to me with a broad grin and on opening it I found a skunk wrapped up in grass. She told us that the previous evening the animal had caused considerable trouble in their camp and her husband had shot it.

Vulpes alascensis abictorum Merriam, BRITISH COLUMBIA RED FOX. — Many tracks and signs seen in the sand barrens between Chezacut Lake and the Itcha Mountains. At one place the Indian guide pointed out a forest-covered round-topped mountain on which he said he had been very lucky trapping foxes.

Canis latrans incolatus Hall, COYOTE. — Found generally distributed everywhere and a number of skulls were secured. Not far from camp I watched with much interest an old grey coyote hunting and catching mice in a meadow bordering the lake. He would watch and listen carefully, then rise up on his hind legs and pounce down on the mice and appeared to be having a most successful hunt.

Lynx canadensis canadensis Kerr, CANADA LYNX. — Rather scarce. Skulls were secured from Horse Shoe Lake and Chesbako River. Near Horse Shoe Lake is a small valley where the Indian trappers take a few lynx annually.

Marmota caligata raceyi Anderson, CHILCOTIN HOARY MARMOT. — Very plentiful throughout the Itcha Mountain Range and found mainly between 6000 and 6500 ft. altitude. These animals were seen in all stages of maturity from young not more than six weeks of age to hoary old chaps weighing from twenty-five to thirty pounds. Seven specimens were collected, five males and two females. The largest male weighed more than twenty-five pounds.

Eutamias amoenus affinus (Allen), COLUMBIAN CHIPMUNK. — Abundant throughout the whole region.

Sciurus hudsonicus hudsonicus (Erxleben), NORTHERN RED SQUIRREL. — Abundant everywhere. Hundreds of nests were found between Chezacut Lake and the Itchas. Most of these nests were in jack-pines twelve to fifteen feet from the ground. As a rule the nests were bulky affairs composed of twigs, pine needles, grass, etc.

Sixteen specimens were collected, all but one being adults. The average external measurements are as follow:

Average 7 males, 332.90-134.0-51.3
Average 8 females, 327.75-133.4-49.8

Glaucomys sabrinus alpinus (Richardson), RICHARDSON FLYING SQUIRREL. — Scarce. Four specimens, one male and three females taken in spruce and pine forest on west side of Chezacut Lake.

Castor canadensis sagitatus Benson, BEAVER. — Almost exterminated. Many old dams, lodges,. etc. were seen in all suitable localities, but fresh signs and cuttings in only three places. During the evening of July 30th a beaver was seen swimming down the Chilcotin River at the outlet from Chezacut Lake. It was very shy and dived the moment it sighted us.

Peromyscus maniculatus artemisiae (Rhodes), SAGEBRUSH WHITE-FOOTED MOUSE. — Very abundant everywhere.

Neotoma cinerea occidentalis (Baird), WESTERN BUSHY-TAILED WOOD RAT. — While signs and nests of these animals were seen, none were taken..

Synaptomys borealis wrangeli Merriam, WRANGELL LEMMING MOUSE. — Rather rare. Only four specimens, three males and a female, were taken in the marsh grass on margin of lake.

Phenocomys intermedius intermedius Merriam, ROCKY MOUNTAIN PHENACOMYS. — These animals are apparently more common in suitable situations than is generally supposed. On August 7th when walking up the hill behind camp an old pine stump about nine inches in diameter was found and this the writer pulled up with the intention of taking it back to camp to put on the evening camp fire. As the stump was lifted up some bearberry cuttings fell out of a hole in a root. Examination disclosed a store of food in a hollow connecting to an opening in a hollow root. While examining this, a young mouse suddenly appeared at a second opening, it was captured and the opening plugged with grass and the whole stump carried back to camp for further examination. When the plugging was removed the interior hollow was found to contain a nest in which an adult female *phenacomys* and another young one were securred. The nesting cavity was four inches deep by three inches wide and was connected at one side with the hollow containing the food supply. The nest was composed of fine dry grass and some cuttings. Careful examination of the hillside resulted in the finding of many traces and nests of *phenacomys* and nearly all the runways were under small upturned pine stumps and fallen logs and occasionally under a clump of juniper. All nesting sites and runways were in very dry, exposed situations on the jackpine covered hillsides and in every instance close to patches of bearberry, the leaves of which form the principal diet of these *phenacomys*. A number of food caches were found and these contained from one to two handfuls of cuttings. Two of these caches contained the following assortment.

No. 1	Bearberry	85%
	Soapolallie	5%
	Wild rose	5%
	Vetch	5%
No. 2	Bearberry	90%
	Soapolallie	7%
	Rose, aspen and strawberry	3%

The runways were not extensive and were found only close to nesting sites and under logs. Several middens examined were all within a few inches of the nests and each contained from about a half to a cupful of droppings.

With those caught by hand and very careful trapping only eleven specimens were taken, seven adults and four juveniles and of these seven are males and four females. Two of the females carried five fœtuses each (8x13 mm. and 10x13 mm. respectively) and one female four fœtuses 6x9 mm.

From information gained trapping these *phenacomys*, it appears that these animals do not come out to feed nightly but gather up a quantity of cuttings and then remain denned up until the food supply is exhausted when they come out for a further supply. They refused to touch bait of any kind and the only satisfactory manner of trapping was to set the traps in the runways.

The second young *phenacomys* captured was kept alive for two days and was fed bearberry and other leaves. It was very tame and unafraid and would sit up on its haunches like a squirrel and munch away at the bearberry leaves which it preferred to anything else. Unfortunately this little animal was found dead on the morning of the third day.

Clethrionomys gapperi saturatus (Rhodes), BRITISH COLUMBIA RED-BACKED MOUSE. — Found only in the spruce woods. Ten specimens were preserved, five males and five females. Nine of these were taken about Chezacut Lake and

one behind the camp in the Itcha Mountains. Several redbacks were seen alive when riding through the spruce forests between Chezacut Lake and the Itcha Range.

Microtus pennsylvanicus drummondii (Audubon & Bachman), DRUMMOND MEADOW MOUSE. — Very abundant in the marsh grass about the lakes and streams and in the wild hay meadows. Twenty-seven specimens were taken. The average and extreme measurements of five males and five females from Chezacut Lake are as follows:—

Length, 168.8 (160-173); tail, 47.5 (45-50); hind foot, 19.5 (18-21).

Ondatra zibethica osoyoosensis (Lord), ROCKY MOUNTAIN MUSKRAT. — Fairly numerous. Four specimens were taken at Chezacut Lake. Most of the small streams and lakes abound with signs of these animals. When netting fish in the lakes the Indians frequently find young muskrats caught in the nets and drowned.

Zapus hudsonius tenellus Merriam, KAMLOOPS JUMPING MOUSE. — Nine specimens secured about the margin of Chezacut Lake. Five males and four females.

Zapus princeps saltator Allen, STICKEEN JUMPING MOUSE. — Two specimens of *saltator* were seen at Chezacut Lake. William B. Davis (*Journal of Mammalogy* 15: 226, 1934) considers these two specimens intergrades between *saltator* and *kootenayensis*, but referable to *saltator* due to cranial characteristics.

Erethizon epixanthum nigrescens Allen, DUSKY PORCUPINE. — Nowhere very common, although several adults and young were seen at different points. An old male weighing thirty pounds was taken at Chezacut Lake. It was found to be badly infested with the roundworm type of parasite. A porcupine was found curled up in the long grass in a meadow by Horseshoe Creek. It refused to be disturbed and merely moved its head about, blinking in the strong sunlight. The hair covering this animal's shoulders was very long and quite brown at the base.

Ochotona princeps brooksi Howell, SHUSWAP PIKA. — We found these animals in the Itcha Mountains only and there they were not very numerous although many suitable rock and lava slides in sheltered positions held their quota of rock rabbits. Two specimens were taken; one of these, an old male, was indentified by the U. S. Biological Survey as *brooksi*, extending the northerly range of this subspecies.

Lepus americanus columbiensis Rhodes, BRITISH COLUMBIA SNOW-SHOE RABBIT. — Plentiful in suitable locations and especially in the willow brush in the spruce swamp at the north end of Chezacut Lake. We were told that the rabbits had nearly all died off in the winter of 1927-28.

Odocoileus hemionus (Rafinesque), MULE DEER — Only occasionally seen and not nearly so plentiful as the moose. No signs of deer were seen southward between Chazacut Lake and the Fraser River.

Alces americana (Clinton), MOOSE. — During the past twenty-five years moose have come into the Chilcotin in increasing numbers, drifting in from the north and east. White men and Indians all agree that prior to that time the moose was unknown. Lame Billy, the local medicine man at Chezacut, stated that when his tribe had killed the first two moose seen they were afraid to eat them, never before having seen such ugly-looking animals. Needless to say these Indians have no compunction regarding moose meat as food at the present time and as soon as one is shot they immediately camp on the spot, build a pole framework, cut up the meat in strips and dry it over a slow fire. This saves much trouble as the dry meat is very light and easily packed out. During the summer months a few cow moose are to be found about Chezacut Lake, but on the higher levels only bulls were encountered. About the Itcha Mountains these animals were numerous and many old shed antlers in different stages of preservation were found; the majority of these were very small, but a few really large antlers were seen. Skulls were scarce even about the old Indian encampments and on enquiry I was told that the Indians, owing to some belief, always try to burn the head as soon as possible. Seldom were any signs of moose found over 5500 feet altitude and the most frequented meadows were around the 5000 foot level.

One evening when riding into camp we came upon two bull moose; one hid behind some bushes, but the other stood in full view and allowed us to approach within a few yards before taking alarm. This animal had a fine set of antlers still in the velvet.

Rangifer montana Seton Thompson, CARIBOU. — Formerly ranging over the Chilcotin in large numbers, these animals have almost disappeared. On questioning a number of Redstone Indians, I gathered that forty or fifty years past caribou were to be found in large

numbers over the whole of the Chilcotin plateau and that they believed there were still thirty-five or forty caribou to be found about the Itcha Mountains. Old signs and remains found in these mountains indicated that at one time caribou must have been extremely numerous and from Moore's Flats up into the Itchas old decaying antlers were very common. A few fresh tracks were seen at an altitude of 6500 feet.

On August 15th, we ascended Caribou Creek, the margins of which were carpeted with great beds of water willow-herb in bloom. Leaving the creek we worked our way over the mountains which form the northern boundary of the range. Here, in a small bleak valley, was found the complete skeleton of a bull caribou, this animal having been killed by an Indian during the summer of 1930. The skull and antlers were taken out to camp the following day on a pack horse. We met a Blackwater Indian named François who was out on a hunting expedition but who told us he was merely on his way home from Bella Coola. Unfortunately for François' veracity he was travelling in the wrong direction and later we caught sight of him crossing a distant mountain diligently following the caribou trail seen during the morning.

THE BEAVER OF THE RIDING MOUNTAIN, MANITOBA

AN ECOLOGICAL STUDY AND COMMENTARY

By H. U. GREEN

(*Continued from Page* 8)

VOICE; MEANS OF COMMUNICATION

Like most mammals, the beaver expresses several emotions by vocal means. I have, however, little to offer regarding the beaver's voice, other than what I have heard while listening outside the lodges to the muffled sounds within. It may be said, though, that they have not much to say.

Beaver "kittens" bicker and squabble when hungry, especially if there are more young to feed than the mother has teats, which is often the case. To my ears, their voice on this occasion is very much like the subdued, irritable mewling of a human infant. When nursing contentedly little grunts of satisfaction are obvious, and when scuffling about, presumably in play, a melodious churr is often evident. I have never heard beaver "kittens" squeak or squeal. One little fellow captured by Grey Owl and myself was quite mute when taken from the water, although trembling and very afraid, and, during the two days it was about camp, it never uttered a sound.

Adult beavers inside the lodge are usually very quiet, but sometimes nursing mothers purred to their young or spoke to them with a low whine which seemed to register mild annoyance. Many hours were passed lying on the sloping sides of the lodges under observation listening through a small hole to what was going on inside, but unfortunately a great number of confused sounds can neither be interpreted nor expressed in words.

On land and in water vocal silence is the general rule. This does not imply that the beavers were always quiet. In fact they are often quite noisy. The grating of chiselling teeth when lumbering operations are under way informs all and sundry of what is going on. But by far the loudest noise is the resounding slap of a beaver tail struck smartly and with deliberation on the surface of water. If beavers were abroad I was usually greeted with a tail slap long before the ponds were reached, a probable intimation to the remainder of the family that possible danger approached. Some times, though, this action seems to serve no other purpose except the enjoyment the beaver obtains from the commotion, for I have frequently observed them, singly and in pairs, slap the water and dive only to appear a few seconds later to repeat the performance several times before swimming away with other objects in view. That the tail is used in this manner as a medium for warning the other inmates of a pond that animal forms are about, there is really little doubt, but whether apprehensively or not, I can not say. For instance, I have at different times when observing the ponds from cover seen wapiti, moose, and smaller deer suddenly appear from the surrounding forest while beavers were swimming or working in the vicinity. Sometimes they slapped their tails and dived, but often they gave no heed to what was a daily occurrence. The nearness of humans produced similar reactions. The logical explanation appears to be that beavers take no chances. When the wind

is favourable to the reception of scent the origin of a sound reaching their sensitive ears is understood. On the other hand, sound without scent, however familiar it may be, offers possibilities of danger. From experience, the scent of forest dwelling animals of the deer family predicted no harm. Humans, too, had never molested them and so were also accepted at a respectful distance without fear.

Voided castoreum is undoubtedly another means of communication, a sign by scent that other beavers live thereabouts or have passed by. Castoreum may also act as a medium for attracting unmated individuals to each other.

That beavers while wandering abroad void castoreum for some useful purpose was evident on two occasions along the course of the Vermilion River between Sites Nos. 1 and 3. In May, 1930, between Sites Nos. 1 and 2 and within 200 yards of the cabin at Mile 32, Dauphin — Clear Lake Road, I found a characteristic beaver sign heap of wet mud, about 9 inches across and 3 inches high, beside the water. It had been built the night before and probably by the male beaver from Site No. 1, who was then absent from the pond. Fresh beaver tracks were evident thereabouts, and the marks of beaver "hands" quite noticeable on the sides of the heap. A little water lay in a small depression on the upper surface, covered with a thin oil film. No smell was noticeable until one's nose was close to the heap, when a slight musky odour could be detected.

In June, 1931, a similar heap was encountered between Site No. 2 and the mouth of Spruce Creek, but no musky odour was noticed. There was, however, the distinctive strong smell associated with stale urine. I think it is quite evident that sign heaps and castoreum are employed as a means of communication, but why there should be any direct relation between them, I am unable to say, for, in themselves, both are characteristic of beavers and not simulated by any other forest dwelling animal.

At one particular spot in the wet grass beside the edge of the ponds at Sites Nos. 1, 2, and 3, beaten flat by the tramping of many beaver feet, a strong odour was always evident, especially on warm days,—a smell suggesting urine rather than castoreum. The beavers were never seen thereabouts and evidently made their visits under cover of darkness. It may be possible that these places were habitually used for voiding urine, and possibly castoreum as well. As an indirect means of communication they would be very noticeable to travelling beavers, suggesting to them without further investigation that the ponds were occupied and intrusion unwelcome.

Many other indirect means of communication are suggested by a visit to any beaver site. The presence of newly felled trees, paths and canals, for instance, would intimate the near presence of others of their kind in the same manner as human activities advise us of man's presence in the wilderness. The mind of the beaver would be quite equal to deduction even without beaver smell to guide them.

TIMES OF ACTIVITY

During the open seasons of the year, night is the period of the beaver's greatest activity. Lumbering, consumption of land-growing plants, harvesting the winter food supply, and repairs to dams and lodges, are invariably accomplished between sunset and sunrise. This does not mean that the beaver is strictly nocturnal in its habits, for it is abroad at more or less definite hours during the day. My observations show that after resting in the lodge from the night's excursion, the first daily appearance on the surface of the pond, irrespective of weather conditions, is about 11 a.m. At this time beavers may be seen swimming aimlessly around or journeying to and from some favoured place on the edge of the water, feeding or gathering food. About 2 p.m. they again appear for a short time, swimming around the pond as if to see that all is well. When the sun begins to sink below the canopy of the surrounding trees a general movement of the entire family is usually evident; young and old have something in view, but what it is, is not always clear.

Except in cases of emergency, most of the beaver's work is performed in the autumn. At this time lumbering is extensively carried on to secure branches and twigs for winter food, and material to repair and strengthen the lodges weathered by the sun and rain. During the spring and summer little in the way of actual labour is noticed, other than what is necessary to keep the pond habitable by the retention of sufficient water. This, usually, is of no moment, unless bad breaks occur in the dam.

The popular idea that the beaver is a paragon of industry seems to me rather an exaggeration of fact. The creation of a suitable pond in which to live, and the construction of a lodge for protection against the elements, is undoubtedly a laborious undertaking, but once they are complete beavers have little to do but loaf about and enjoy life, except at harvest time.

Every task is masterfully performed for a useful purpose. The beaver wastes no energy in unfruitful endeavour, which, after all, is no more than one should expect of any intelligent mammal.

Activity during the winter months is, as a rule, confined to the lodge and the water beneath the thick covering of ice, which persists on the beaver ponds of the Riding Mountain from November until April. It would be very difficult to learn the daily routine of the beavers' monotonous existence during their enforced imprisonment. I suspect, though, that much time is whiled away in sleep, alternating with journeys to the food pile and exercise in the icy water until the need for air demands their return home.

That beavers do leave their ponds after being frozen in came to my notice during the winter of 1931-1932. The record, however, is unusual as far as the beaver of the Riding Mountain are concerned.

On December 26th, 1931, I visited Site No. 1 in company with A. Burton Gresham, ornithologist, of Winnipeg, Manitoba. The temperature for several days previous was well below zero. On the day in question the thermometer registered minus 11 degrees F. (I had previously visited the pond on December 7th. The beaver family were in the lodge, and the surroundings gave evidence that everything was normal). We at once noticed a wide and well beaten trail on the snow-covered surface of the pond, made by dragging beaver tails, leading from an aperture at the crest of the dam, some 30 yards distant from the lodge, to a stand of small aspens on the edge of the pond 37 yards away. The base of several aspen trunks had been lightly barked by the beavers, but no attempt was made to fell them. On January 17th, 1932, no fresh beaver signs could be seen, and the aperture at the crest of the dam, opened by the beavers with premeditated design, was sealed with muck. During the balance of the winter the beavers remained below.

There appears to be no explanation for this unusual deviation from established conduct. The weather at the time certainly offered no inducement to leave the pond. Neither could hunger furnish the motive, as a sufficient quantity of food was stored in the deep water beside the lodge to last until spring.

From what I have learnt there is reason to believe that wandering and migrating beavers travel by night, lying up for the day as near water as possible.

(To be continued)

CHRISTMAS BIRD CENSUSES, 1935

WOLFVILLE, KINGS COUNTY, NOVA SCOTIA, DECEMBER 25, 1935.—Sky heavily overcast. Moderate north-west wind. Temperature 20° F. Approximately 8 inches of snow covering the ground. Travelling along, I visited the districts south-west and north of the town of Wolfville, which comprise uplands sparsely covered with evergreens, orchards and farms and lowland meadows which skirt the Cornwallis River and tidal marshes. Observations were made between 10 a.m. and 12 m.

Herring Gull, 24; Northern Blue Jay, 14; Eastern Crow, 11; Red-breasted Nuthatch, 7; Brown Creeper, 1; Eastern Robin, 1; Eastern Golden-crowned Kinglet, 3; English Sparrow, 11; Canadian Pine Grosbeak, 19; Redpoll (sp.?), Pine Siskin, and Eastern Goldfinch, approximately 1000 in aggregate; Slate-coloured Junco, 11; Eastern Tree Sparrow, 1; Eastern Song Sparrow, 1. Total, 15 species, approximately 1104 individuals.

It seems pertinent to include a few explanatory notes concerning some of these observations. For instance, the Redpolls, Siskins and Goldfinches are exceedingly abundant here this winter and flocks of varying sizes all intermingled were frequently met. Some of these examined at close range, while feeding in the alders and low evergreens, showed the 3 species but in each case the Redpolls were predominant. The Herring Gulls were seen alighted on the water near a steamer which was loading apples at Port Williams and were readily identified as all belonging to this species. One conversant with the gull population along the coast of the Maritime Provinces during the winter season would naturally expect to find some of the "white-winged" varieties present in a flock of this size, but as a matter of fact I have never seen any of these about the Minas Basin ports in this general region. They are commonly seen in winter about such ports as Halifax, Digby, Yarmouth and doubtless at others which, unlike those in this part of Nova Scotia, are

near the open coast. For some weeks the Song Sparrow and Robin have been daily frequenting the feeding station in my own yard.—R. W. TUFTS.

MONTREAL AND DISTRICT, DECEMBER 22, 1935.—Clear and cold; mean temperature for the day at McGill University 1.1° below zero F.; moderate westerly wind; snow lying 8 inches deep. Areas visited: Mount Royal, 8.40 a.m.—12.40 p.m. (Wynne-Edwards); Cote St. Luke, 8.30 - 12 noon (Jackson, Nicol, Outhet); Longueuil and Montreal South, 9 a.m. - 12.30 p.m. (Terrill); St. Lambert, Laprairie and La Tortue, 2 p.m. - 4.15 p.m. (combined parties). Total distance, about 25 miles on foot, 22 miles by motor. Number of observers, five.

American Golden-eye, 79; Merganser (American Common or Red-breasted), 2; American Goshawk, 1; Herring Gull, 1; Great Horned Owl, 2; Hairy Woodpecker, 1; Downy Woodpecker, 9; Blue Jay, 1; American Crow, 151 (partly estimated); Black-capped Chickadee, 34; White-breasted Nuthatch, 5; Brown Creeper, 2; American Robin, 2; Northern Shrike, 1; Common Starling, 185 (partly estimated); Common Purple Finch, 4; Pine Grosbeak, 3; Redpolled Linnet, 67; Snow Bunting, 130 (estimated). House Sparrows were not counted. Total, 18 native species, 2 alien species; about 680 individuals (excluding House Sparrows).

Species seen recently include Ruffed Grouse, Song Sparrow (Montreal); Brown-headed Chickadee, Red-breasted Nuthatch (Ste. Adèle, Terrebonne Co.).—H. A. C. JACKSON, A. C. NICOL, R. A. OUTHET, L. M. TERRILL, V. C. WYNNE-EDWARDS. (*Province of Quebec Society for the Protection of Birds.*)

OTTAWA, ONTARIO, DECEMBER 22, 1935. — Twenty observers, organized in eight separate parties, took the annual Christmas Bird Census in the vicinity of Ottawa on December 22nd. The weather experienced was a fine example of the best that winters in this region bring to us. The sky remained cloudless throughout the day, the wind was westerly and very light, and the temperature ranged from -13° F. at 8.00 a.m. to -2° F. at 3.00 p.m. The ground was covered with snow that was, on the average, about eight inches deep.

The census, as the records show, provided a very fair cross-section of normal winter bird life at Ottawa, with no unusual species.

The four species mentioned below were recorded in numbers that exceeded those in which they had been recorded in any previous census of this kind in this area.

	Numbers, 1935	Previous max.
American Golden-eye	57	52 in 1932
Common Pheasant	4	2 in 1933
Redpolled Linnet	117	107 in 1929
Tree Sparrow	16	15 in 1924

Black-capped Chickadees, which reached a record scarcity in the census of December, 1934, when only 5 of them were recorded, show an excellent recovery this year, with a total of 90 individuals, although they have not yet returned to their normal abundance.

The parties participating in the taking of the 1935 census and the routes followed, in East, South, West, North order, were: (1) Hoyes Lloyd, Grace S. Lewis, 8.00 a.m. to 4.45 p.m., south bank of Ottawa River, eastward from Rideau Gate to Ottawa airport, including village of Rockcliffe Park and property of Federal District Commission, 11 miles by auto, 9 miles on foot; (2) R. M. Anderson, 10.00 a.m. to 12.30 p.m., Ottawa East and along Rideau River to Main Street, returning by Echo Drive, 4 miles on foot; (3) C. E. Johnson, C. M Sternberg, and G. W. Dennis, 9.00 a.m. to 1.30 p.m., Bronson Avenue refuse-dump, thence via White's Bridge to Bailey's farm, then from Billing's Bridge southward 4 miles along the Metcalfe Road, 8½ miles by auto, 4 miles on foot; (4) R. E. DeLury and George Clark, 8.00 a.m. to 3.00 p.m., Experimental Farm, Rideau Canal and River to Hog's Back and Black Rapids, and return, 15 miles by auto, with short walks at several stops; (5) B. A. Fauvel, Mr. and Mrs. T. C. Wylie, 12.30 p.m. to 5.00 p.m., Ottawa to Britannia, 9 miles on foot; (6) Harrison F. Lewis, G. H. Hammond, Barnard McL. Lewis, and C. R. Lewis, 10.25 a.m. to 5.00 p.m., Champlain Bridge to Deschenes, Aylmer, and Queen's Park, 7 miles by auto, 11 on foot; (7) Arthur B. Nelles, 10.00 a.m. to 4.30 p.m., Old Chelsea to Kingsmere and Wrightville, 12 miles on skis; (8) W. H. Lanceley, R. F. Clarke, and H. J. Keith, 10.00 a.m. to 3.30 p.m., Gatineau Point to Farmer's Rapids and 3 miles beyond, 7 miles by auto, 5 on foot.—HARRISON F. LEWIS, *Chairman of Bird Census Committee.*

CHRISTMAS BIRD CENSUS, OTTAWA, ONTARIO, DECEMBER 22, 1935.

Species of Birds	Route Nos. as in Text								
	1	2	3	4	5	6	7	8	Total
American Golden-eye	..	..	..	..	50	7	..	..	57
Ruffed Grouse	2	..	4	..	..	..	1	..	7
Common Pheasant	..	..	1	2	1	..	..	..	4
Great Horned Owl	..	..	1	..	..	..	..	..	1
Hairy Woodpecker	2	..	..	..	..	..	1	1	4
Downy Woodpecker	3	..	..	5	5	1	..	..	14
Blue Jay	..	..	..	2	..	1	1	..	4
American Crow	..	15	2	5	75	..	..	..	97
Black-capped Chickadee	..	..	13	14	25	25	9	4	90
White-breasted Nuthatch	3	..	1	4	5	1	..	7	21
Red-breasted Nuthatch	1	..	..	..	..	..	..	..	1
American Robin	..	..	1	..	..	..	..	..	1
Northern Shrike	..	..	..	1	2	..	..	..	3
Common Starling	..	150	100	8	6	2	..	1	267
English Sparrow	5	300	250	65	50	10	..	52	732
Red-polled Linnet	28	..	34	7	..	48	..	..	117
Pine Siskin	..	..	43	12	..	..	..	..	55
American Goldfinch	..	..	..	..	..	1	..	..	1
Tree Sparrow	..	..	..	10	..	..	..	6	16
Snow Bunting	..	..	..	20	..	..	..	..	20
Total Individuals	44	465	450	155	219	96	12	71	1512
Total Species	7	3	11	13	9	9	4	6	20

PAKENHAM, ONTARIO, DECEMBER 26, 1935. — 8 a.m. to 12.15 noon. Intermittent sunshine; light west wind; 6 inches snow; 5 below zero at start, zero at noon. Observers separate, travelled 16 miles.

Ruffed Grouse, 9; Eastern Hairy Woodpecker, 7; Blue Jay, 8; Black-capped Chickadee, 68; White-breasted Nuthatch, 5; Red-breasted Nuthatch, 6; Northern Shrike, 1; Common Starling, 15; English Sparrow, 4; Snow Bunting, 3. (Last of a flock, two other flocks heard during morning.) Total, 10 species, 126 individuals. Other species present, but not seen on Census Day, Pileated Woodpecker, Downy Woodpecker, Redpoll.—EDNA G. ROSS, V. M. ROSS, ALLAN F. ROSS.

ARNPRIOR, ONTARIO, DECEMBER 25, 1935.—10.00 a.m. to 5.00 p.m., weather fine, 8 inches snow on ground, wind west, light, temperature 0° at start, 3° at return. Eighteen miles on foot, partly on snowshoes. Observers separate.

Canada Ruffed Grouse, 2; Northern Pileated Woodpecker, 1; Eastern Hairy Woodpecker, 2; Northern Downy Woodpecker, 3; Northern Blue Jay, 8; Eastern Crow, 1; Black-capped Chickadee, 37; White-breasted Nuthatch, 8; Red-breasted Nuthatch, 2; Common Starling, 13; House Sparrow, 1 plus; Eastern Evening Grosbeak, 47; Northern Slate-coloured Junco, 1; Common Snow Bunting, 65. Total, 14 species, 191 (plus) individuals. Subspecies determined geographically.

Several familiar winter species are absent this year and the Ruffed Grouse has reached a very low ebb. (On the other hand the Varying Hare and White-footed Mouse are very abundant).—LIGUORI GORMLEY and CHARLES MACNAMARA.

SILLSVILLE, ONTARIO, DECEMBER 25, 1935. — 10 a.m. to 4.30 p.m. Bright; light westerly wind in a.m., almost calm in p.m.; temperature at start 2°, at finish 8°, about 12 inches of snow on ground. About 5 miles covered on foot in vicinity of M. B. Whyte's farm.

American Rough-legged Hawk, 2; Canada Ruffed Grouse, 4; Eastern Hairy Woodpecker, 1; Northern Downy Woodpecker, 3; Arctic Three-toed Woodpecker, 1 (female); Black-capped Chickadee, 42; White-breasted Nuthatch, 4; English Sparrow, 1; Redpoll (sp.?), 4; Common Snow Bunting, 500 (est.). Total, 10 species, 562 individuals.

The Three-toed Woodpecker was clearly seen, all its distinctive markings were carefully noted, and it was positively identified.—GEORGE SCOTT SMITH.

HALIBURTON, ONTARIO (Lat. 45°), DECEMBER 25, 1935.—6 hours afield. Clear; wind northwest, light; temperature -28° at start; 10 inches snow.

Route located between Burnt and Drag Rivers, at altitude of about 1200'; distance about 10 miles.

Canada Ruffed Grouse, 3; Northern Pileated Woodpecker, 2+; Eastern Hairy Woodpecker, 9; Northern Downy Woodpecker, 2; Northern Blue Jay, 1+; Black-capped Chickadee, about 60; Red-breasted Nuthatch, 2; Eastern Golden-crowned Kinglet, 2; Canadian Pine Grosbeak, about 40; Common Redpoll, 15. Total, 10 species, about 136 individuals. Other species within a month—Herring Gull, November 26; Common Loon, November 30; Eastern Evening Grosbeak, December 2; Arctic Three-toed Woodpecker, December 16; White-breasted Nuthatch and Common Snow Bunting, December 23. The Common Starling and English Sparrow are residents in the village.—E. W. CALVERT.

TORONTO, ONTARIO, DECEMBER 22, 1935.—The 11th Christmas Bird Census of the Brodie Club was taken on one of the coldest days ever chosen

CHRISTMAS BIRD CENSUS OF THE BRODIE CLUB—TORONTO
DECEMBER 22, 1935

Species	Parties	1	2	3	4	5	6	8	Totals
Greater Scaup Duck		....	....	....	3000	1522	201	....	4723
American Golden-eye		....	....	....	83	244	52	....	379
Old-squaw		....	....	....	252	95	220	....	567
American Common Merganser		....	1	....	2	51	....	....	54
Eastern Goshawk		....	2	....	....	....	....	....	2
Cooper's Hawk		....	1	....	....	....	....	....	1
Eastern Red-tailed Hawk		1	4	....	....	....	....	....	5
American Rough-legged Hawk		....	1	....	....	....	1	....	2
Marsh Hawk		....	....	....	....	....	1	....	1
Eastern Sparrow Hawk		....	....	1	....	....	....	....	1
Common Pheasant		14	6	8	7	7	1	....	43
Glaucous Gull		....	....	....	....	2	....	....	2
Great Black-backed Gull		....	....	....	1	25	8	....	34
Herring Gull		2	2	24	71	848	190	1	1138
Ring-billed Gull		....	....	....	....	3	51	....	54
Eastern Mourning Dove		....	1	....	....	....	....	..	1
Eastern Screech Owl		....	....	....	....	....	1	....	1
Eastern Belted Kingfisher		....	1	....	1	....	....	....	2
Northern Flicker		....	....	1	....	....	....	....	1
Red-headed Woodpecker		....	....	....	1	....	....	....	1
Eastern Hairy Woodpecker		....	5	1	6	....	....	3	15
Northern Downy Woodpecker		2	7	3	9	2	2	2	27
Northern Blue Jay		....	8	2	29	2	....	1	42
Eastern Crow		1	....	25	....	....	....	....	26
Black-capped Chickadee		25	90	34	55	29	9	14	256
White-breasted Nuthatch		1	5	1	7	1	....	2	17
Brown Creeper		....	3	2	7	....	....	2	14
Eastern Robin		....	2	1	....	....	....	....	3
Eastern Golden-crowned Kinglet		....	....	....	....	4	....	....	4
Eastern Ruby-crowned Kinglet		....	1	....	....	....	....	....	1
Northern Shrike		....	....	1	1	....	1	1	4
Common Starling		31	64	52	235	162	525	23	1092
English Sparrow		130	170	426	466	1275	310	62	2839
Eastern Meadowlark		....	....	1	....	....	....	....	1
Eastern Redwing		....	....	....	1	....	12	....	13
Eastern Cardinal		....	....	2	....	....	....	....	2
Eastern Purple Finch		....	2	....	....	....	....	....	2
Common Redpoll		....	25	29	110	....	1	32	197
Pine Siskin		....	50	....	....	....	22	....	72
Eastern Goldfinch		....	....	....	....	2	....	....	2
Slate-coloured Junco		1	8	24	37	10	1	69	150
Eastern Tree Sparrow		1	25	41	92	40	50	2	251
White-throated Sparrow		....	....	1	....	....	....	....	1
Swamp Sparrow		....	....	....	3	....	....	....	3
Eastern Song Sparrow		....	7	3	9	....	2	1	22
Common Snow Bunting		....	....	6	2	....	....	50	58
Total Individuals		209	491	689	4487	4324	1661	265	12126
Total Species		11	25	23	25	19	21	15	46

Sub-species determined geographically.

by the Club for a census. The maximum temperature recorded was 18 above zero and the minimum 10 above. Despite the cold it was a pleasant day to be in the field as the sky was clear most of the day and there was practically no wind. About 2 inches of snow covered the ground and all still water was frozen. Snowfall for December has been less than normal but temperatures have been lower than the average, with official marks of 2 below zero on the 4th and 6 below on the 21st. Thirty-one observers were out, the earliest at 8 a.m. and the latest 4.30 p.m. All of the usual routes were covered with the exception of No. 7 along the eastern lake shore.

The appended list shows the highest number of species and individuals yet recorded. The high total of individuals is largely accounted for by Greater Scaup Ducks and English Sparrows, the former counted in thousands for the first time and the latter never having been counted before. Whether or not it has any deep significance it might be worth recalling the figures for Scaups on the last four census lists, namely: 1932—250, 1933—400, 1934—678, 1935—4723. A considerable invasion of Goshawks has been indicated in southern Ontario in the late autumn of 1935 and the species appears in the census for the first time, as do the Marsh Hawk, Mourning Dove and Ruby-crowned Kinglet. The Kinglet record appears to be the first for Toronto in winter. The bird was associating with the Chickadees. An invasion of Redpolls and Siskins is reflected in the totals for these species and the census lists for 11 years show the curious fact that the greatest numbers of Hairy Woodpeckers, 12 in 1929 and 15 in 1935, occurred in years when Redpolls and Siskins were unusually common. The average number of Hairys included in censuses, excluding those two years, is 2.

The parties of observers were made up as follows: 1, H. M. Halliday, D. Sumner; 2. L. L. Snyder, R. J. Rutter, G. S. Bell, T. F. McIlwraith, Colin Crawford, F. Banfield, J. M. Speirs, L. A. Prince, R. G. Dingman; 3, C. E. Hope, S. C. Downing, R. M. Saunders; 4, J. L. Baillie, R. A. Smith, W. C. Mansell, R. A. Scadding; 5, P. Harrington, T. M. Shortt, A. E. Allin, E. G. McDougall; 6, R. V. Lindsay, S. L. Thompson, H. H. Southam, D. MacKinnon; 8, F. H. Emery, H. H. Brown, H. G. Macklin, R. D. Ussher, W. W. H. Gunn.—THE BRODIE CLUB — R. J. RUTTER, *Secretary*.

KITCHENER and WATERLOO, ONTARIO, DECEMBER 22, 1935. — Weather cold (10° to 18°); sky clear at start, partly cloudy during day and cloudy at finish; good visibility all day; moderate west breeze; snow 6 inches deep; trees heavily laden with snow for past week.

Birds generally scarce, several observers searched good territory for over an hour in early afternoon without seeing a single bird. Five parties covered 5 different regions within five miles radius of Kitchener at various times between 9 a.m. and 4 p.m., about 6 square miles well covered.

American Common Merganser (?) 2; Sharp-shinned Hawk, 2; Ruffed Grouse, 5; Common Pheasant, 4; Herring Gull, 4; Ring-billed Gull, 2; Hairy Woodpecker, 4; Downy Woodpecker, 7; Black-capped Chickadee, 130; White-breasted Nuthatch, 8; Brown Creeper, 1; Golden-crowned Kinglet, 1; Common Starling, 200; American Goldfinch, 17; Slate-coloured Junco, 15; Tree Sparrow, 2; Song Sparrow, 1; Snow Bunting, 150. Total, 19 species, 554 individuals. —Allen Bain, Fred Bender, Ronald Brooman, Fred Cooper, Joyce Dancy, F. W. R. Dickson, Herb Longstreet, F. H. Montgomery, C. B. Price, F. A. Shantz, J. W. Spiers, Lorne Wettlaufer.

VINELAND, ONTARIO, DECEMBER 27, 1935.—Two parties of two observers each in the field, one party covered 3 miles on foot and 5 miles by car, from 8 a.m. till 12 noon. The other party covered 4 miles on foot and 7 miles by car and was afield from 9.30 a.m. till 12.30 p.m. The day was quite overcast at first, with a strong west wind blowing. About 10.30 a.m. a fair amount of snow fell. Subsequently the sun came out. Temperature, 17° at start. Territory covered included a small portion of Lake Ontario shore, fruit and mixed farming land, marsh, and both hardwood woods and mixed woods.

Duck (sp.?), 2; Common Pheasant, 2; Herring Gull, 2; Eastern Hairy Woodpecker, 1; Northern Downy Woodpecker, 8; Northern Blue Jay, 7; Black-capped Chickadee, 10; White-breasted Nuthatch, 2; Brown Creeper, 1; Eastern Golden-crowned Kinglet, 7; Common Starling, 375; House Sparrow, 59; Slate-coloured Junco, 25; Eastern Tree Sparrow, 55; Eastern Song Sparrow, 3. Total, 15 species, 559 individuals.—W. J. K. HARKNESS, W. E. HURLBURT, D. ROSS, F. STRONG.

HAMILTON, ONTARIO, DECEMBER 27, 1935. — 8:00 a.m. to 5:30 p.m., N. W. wind, fair, temperature 15° to 26°, 8 inches of snow, Bay frozen over. Observers in ten parties covering Burlington Bay, Dundas Marsh, The Escarpment, Stoney Creek, Lake Shore to Bronte.

Mallard Duck, 4; Black Duck, 200; Green-winged Teal, 1 (G.N.); American Golden-eye, 70; Buffle-head, 1; Old-squaw, 8; King Eider, 1 (G.N.); American Common Merganser, 60; Red-breasted Merganser, 6; Cooper's Hawk, 1; Red-tailed Hawk, 3; Red-shouldered Hawk, 1; Common Rough-legged Hawk, 3; Bald Eagle, 1 (H.W.); Marsh Hawk, 3 (E.M.); American Sparrow Hawk, 2; Ruffed Grouse, 2; Gray Partridge, 37 (2 coveys); Common Pheasant, 112; Great Black-backed Gull, 34; Herring Gull, 450; Ring-billed Gull, 1; Mourning Dove, 7 (G.S.); Great Horned Owl, 1; Snowy Owl, 1; American Long-eared Owl, 1; Yellow-shafted Flicker, 3 (G.S.); Hairy Woodpecker, 4; Downy Woodpecker, 41; Horned Lark, 9; Blue Jay, 20; American Crow, 10; Black-capped Chickadee, 151; White-breasted Nuthatch, 21; Brown Creeper, 5; Winter Wren, 1; American Robin, 2; Golden-crowned King'et, 7; Northern Shrike, 1; Common Starling, 715; English Sparrow, 575; Cardinal, 6; Redpoll (sp.?), 103; Pine Siskin, 17; American Goldfinch, 24; Slate-coloured Junco, 111; Tree Sparrow, 173; Chipping Sparrow, 1 (G.K.); White-throated Sparrow, 1 (G. N.); Swamp Sparrow, 1 (G.N.); Song Sparrow, 11; Snow Bunting, 230. Total 52 species, 3254 individuals.

These species have also been seen during the past week: Common Loon, 1; Pintail, 1; Ring-necked Duck, 1; Greater Scaup Duck, 80; Hooded Merganser, 1; Sharp-shinned Hawk, 2; Glaucous Gull, 2; American Screech Owl, 1; Belted Kingfisher, 1; Tufted Titmouse, 2; (since Dec. 1); Hoary Redpoll, 1.

NOTE: Since it is generally not possible to identify a sub-species in the field only the name of the species has been given.

Hamilton Bird Protection Society: — Miss Greta Bauer; H. Butcher; Mrs. J. D. Farmer; Ronald Hassell; Rev. H. Heaven; Peter Henderson; Richard Hilborn; G. Knechtel; Mrs. F. MacLoghlin; Miss Elinor Malcolm; J. Martin; Miss Ruby Mills; Dr. and Mrs. G. O. McMillan; Rev. Calvin McQuesten; Mrs. J. P. Morton; George North; H. C. Nunn; Roger Nunn; B. Ronald; G. Sackrider; D. Scott; Emma Smith; Vernon Trott; J. H. Williams.

WOODSTOCK, ONTARIO, DECEMBER 22, 1935. — 9.30 a.m. to 5.15 p.m. Temperature: 4° F. at outset and 12° F. on return. Weather, sunny, with very slight S.E. wind, becoming cloudy and wind changing to N.E. and becoming stronger about 10.15 a.m.. Snow covering, 4 to 8 inches. Trees heavily covered with ice and snow. Eight in party, separating into three groups at various points and working fields along Cedar Creek from Woodstock to 4th Concession South; fields along Sweaburg Road; hardwood area and cedar swamps round Hodge's Pond and Sweaburg. Distance covered: 8 miles by car, 9 miles on foot.

Eastern Goshawk, 1; Ruffed Grouse, 3; Common Pheasant, 1; Eastern Hairy Woodpecker, 4; Northern Downy Woodpecker, 2; Horned Lark (subsp.?), 2; Black-capped Chickadee, 100 plus, in small flocks of 5 to 9; White-breasted Nuthatch, 1; Brown Creeper, 1; Eastern Golden-crowned Kinglet, 11; Common Starling, 20 plus; English Sparrow, uncounted; Slate-coloured Junco, 29; Eastern Tree Sparrow, 15; Eastern Song Sparrow, 2; Common Snow Bunting, 300 plus, in two flocks. Total, 16 species, 492 plus individuals (not counting English Sparrows). Also heard three or four times: Pine Siskins, but not seen and so not included. A freshly impaled *Peromyscus maniculatus bairdi* was found on a thorn bush, probably impaled by a Shrike. Seen on December 21st; Eastern Crow and Horned Grebe.—H. Milnes, E. Dutton, G. Nutt, C. Cooke, C. Pooley, N. Neale, H. Battae and V. Utting. (*Woodstock Naturalist Society*).

LONDON, ONTARIO, DECEMBER 21, 1935. — The Christmas Census of the McIlwraith Ornithological Club followed the plan of previous years, the ground covered being practically the same, while the personnel and territory of the observers was also as far as possible that of previous trips. During the winter the valley of the River Thames is our best hunting ground and this was followed from the city to Delaware during the morning hours, and furnished the bulk of the species noted. At noon the list was made up and a special effort put forth during the afternoon to round up those known to be in the district but which had eluded us earlier in the day. The fact that we only added two or three species would seem to prove that even in the winter the morning is the best time for bird study, something that had perhaps not impressed itself upon us before. The total, 38 species, is a little above the average but not up

to the list of 1934, when many summer birds were found and a total of 44 recorded. The Cowbird is, perhaps, the most interesting find, although it is not the first time one of these birds has been found here in winter. The northern finches, Siskins, Redpolls and Purple Finches, seem to be here in numbers, while Juncos, Tree Sparrows, Brown Creepers and Golden-crowned Kinglets are more numerous than usual. It was nice to find five Red-breasted Nuthatches on census day, a bird that has been decidedly uncommon for several years both in winter and during the migrations. Hawks were well represented, but we fell down badly on Owls, missing even the Great Horned, which is present throughout the year. No doubt we were within a few hundred yards of one or more during the day but just did not happen to stir one up. Sometimes the Crows help us with this task but they too fell down on the job.

Combined list of ten parties, fourteen individuals, some working in the morning, others in the afternoon, practically from daylight until dark. Temperature 8 a.m., 4°; at 1 p.m., 20°; at 6 p.m., 14°. Wind practically nil. Twelve to fifteen inches of very light snow, which made heavy walking. The sun shone at times, but the sky was mostly overcast, with occasional light snow-flurries.

Black Duck, 3; American Golden-eye, 7; American Common Merganser, 30; Cooper's Hawk, 3; Red-tailed Hawk, 9; Red-shouldered Hawk, 1; American Rough-legged Hawk, 2; Bald Eagle, 1; Marsh Hawk, 1; Ruffed Grouse, 2; Bob-white, 12; Common Pheasant, 12; Herring Gull, 33; American Screech Owl, 1; Belted Kingfisher, 5; Northern Flicker, 2; Hairy Woodpecker, 3; Downy Woodpecker, 27; Horned Lark, (subsp. ?), 6; Blue Jay, 22; American Crow, 434; Black-capped Chickadee, 81; White-breasted Nuthatch, 16; Red-breasted Nuthatch, 5; Brown Creeper, 7; Golden-crowned Kinglet, 60; Common Starling, 1118; English Sparrow, 500 (est.); Cowbird, 1; Cardinal, 29; Common Purple Finch, 28; Red-poll (sp. ?), 53; Pine Siskin, 6; American Goldfinch, 2; Slate-coloured Junco, 80; Tree Sparrow, 135; Song Sparrow, 18; Snow Bunting, 70. Total, 38 species, 2825 individuals. Also seen recently but missed census day, Lapland Longspur, two flocks of 100 and 200 birds, respectively, Short-eared Owl, Sharp-shinned Hawk, Wilson's Snipe, Winter Wren, Red-headed Woodpecker, Northern Shrike, American Robin.—McILWRAITH ORNITHOLOGICAL CLUB, PER E. M. S. DALE, *Chairman Census Committee.*

MEAFORD, ONTARIO, DECEMBER 26, 1935.—Morning bright; heavy snowfall in afternoon. Temperature, 15°F., wind N.E. Town, harbour, shore line for 2 miles east of town, Mountain Lake, Walter's Falls.

Scaup Duck (sp. ?), 5; American Common Merganser, 14; Ruffed Grouse, 4; Common Pheasant, 1; Herring Gull and Ring-billed Gull, 35 in all; Great Horned Owl, 1 (heard); Hairy Woodpecker, 2; Downy Woodpecker, 1; Blue Jay, 1 (heard); Black-capped Chickadee, 30; White-breasted Nuthatch, 2; Common Starling, 100; House Sparrow, 75; Redpoll (sp. ?), 3; Snow Bunting, 25. Total, 16 species, 299 individuals.

Also seen near Walter's Falls by another observer: Snowy Owl, 1; Blue Jay, 4; White-breasted Nuthatch, 2; Snow Bunting, 20.—L. H. BEAMER.

VIVIAN, MANITOBA, DECEMBER 27, 1935. — Sharp-tailed Grouse, 34; Great Horned Owl, 1; Barred Owl, 1; Downy Woodpecker, 2; Canada Jay, 3; Black-capped Chickadee, 5; Redpoll (sp. ?), 44; Snow Bunting, 36. Total, 8 species, 126 individuals.—G. RUTHERFORD, C. HALL, B. MACFARLANE, J. MACKIE, and A. M. MACKIE.

WINNIPEG, MANITOBA, DECEMBER 22, 1935. — Five field parties and seven feeding stations; temperature 6° to 8° above zero; wind, 14 miles an hour from north; light snowfall in early morning, changing to bright around noon and cloudy in late afternoon; several inches of snow on ground. Greater Winnipeg, except St. Boniface and Norwood.

Permanent residents: Ruffed Grouse, 4; Prairie Chicken, 1; Sharp-tailed Grouse, 12; Great Horned Owl, 1; Hairy Woodpecker, 10; Downy Woodpecker, 13; Blue Jay, 33; White-breasted Nuthatch, 23; Black-capped Chickadee, 63; Common Starling, 6. Total, 10 species, 166 individuals.

Winter visitants: Snowy Owl, 12; Hawk Owl, 1; Hudsonian Chickadee, 2; Evening Grosbeak, 2; Pine Grosbeak, 17; Hoary Redpoll, 1; Redpolled Linnet, 45; Snow Bunting, 897. Total, 8 species, 997 individuals.

Accidentals: Lesser Scaup Duck, 2; American Crow, 1; Red-breasted Nuthatch, 2; Brown Creeper, 1; White-throated Sparrow, 1. Total, 5 species, 7 individuals. Grand total, 23 species, 1,150 individuals.—NATURAL HISTORY SOCIETY OF MANITOBA, *per* A. G. LAWRENCE, *President.*

Observers: C. L. and Mrs. Broley; Jack and B. W. Cartwright; Miss G. Childs; Ralph Fryer; Mrs. J. S. Jones; Morrey and A. G. Lawrence; A. M. Mackie; Mrs E. J. McMillan; Mrs. A. W. Murdoch; H. C. Pearce; Gordon Rutherford; A. H. Shortt; Mrs. F. H. Telfer; Mrs. H. D. Whellams.

LA RIVIERE, MANITOBA, DECEMBER 22, 1935.—Golden (?) Eagle, 1; Common Pheasant, 1; Downy Woodpecker, 1; Blue Jay, 2; Black-capped Chickadee, 6; White-breasted Nuthatch, 2; Redpoll (sp. ?), 12. Total, 7 species, 25 individuals. Other species seen recently: Sharp-tailed Grouse, 5 on 21st and 23rd; Snow Buntings, 10 on 24th; Slate-coloured Junco, 1 on 17th; Hairy Woodpecker, 1 on 21st; Bohemian Waxwing, 1 on 20th; Arctic Three-toed Woodpecker, 1 on 23rd.—CLARENCE WIGHTMAN.

EAST BAY, MANITOBA, DECEMBER 27, 1935. — Around yard and farm of Edward Robinson. American Goshawk, 1; Ruffed Grouse, 1; Sharp-tailed Grouse, 9; Hairy Woodpecker, 3; Downy Woodpecker, 1; Canada Jay, 1; Blue Jay, 2; Black-capped Chickadee, 8; White-breasted Nuthatch, 1; Bohemian Waxwing, 4; Pine Grosbeak, 10; Snow Bunting, 7. Total, 12 species, 48 individuals.—EDWARD ROBINSON.

SOURIS, MANITOBA, DECEMBER 22, 1935.—Heavy snow fell in morning. Blue Jay, 1; Black-capped Chickadee, 4; White-breasted Nuthatch, 1; House Sparrow, 1; Snow Bunting, 11. Total, 5 species, 18 individuals.—S. H. FORREST.

SASKATOON, SASKATCHEWAN, DECEMBER 22, 1935.—Territory covered, south of Saskatoon, along Saskatchewan River, travelled 8 miles, 5 on foot and 3 by dog-sled. Temperature below zero all day, some snow flurries; observers together.

Sharp-tailed Grouse, 1; Gray Partridge, 4; Snowy Owl, 1; Downy Woodpecker, 1; Magpie, 2; Long-tailed Chickadee, 6; English Sparrow, 20; Common Redpoll, 2. Total, 8 species, 37 individuals.—FARLEY MOWAT and BRUCE BILLINGS.

EASTEND, SASKATCHEWAN, DECEMBER 26, 1935. —9.30 a.m.—5 p.m. Foggy, snow threatening, wind East, started to snow 2 p.m.; temperature, at start 2°, at finish 6°. Little snow, about one inch on the level, a few old drifts. Valley of the Frenchman River and hills to the south. Eleven miles on foot.

Golden Eagle, 1; Prairie Sharp-tailed Grouse, 18; Sage Hen (fresh tracks of 30); Gray Partridge, 42; Common Pheasant, 1; American Magpie, 25; Long-tailed Chickadee, 3; Bohemian Waxwing, 40; Redpoll (sp. ?), 35; Snow Bunting, 9. Total, 10 species, 204 individuals. Seen during same day by other observers: Golden Eagle, 2; Great Horned Owl, 1. A friend whom I met during the day informed me that he had passed along my route earlier in the morning and noted some 30 Sage Hens, where I had found the tracks later on.—L. B. POTTER.

CAMROSE, ALBERTA, DECEMBER 30, 1935.—10.30 a.m. to 4.30 p.m. Snowing all day, 15 inches snow, north-east wind, temperature around zero all day. Observers in two parties, one walked down Stony Creek to Battle River, other walked road to river, then both parties walked through spruce woods on south side of river; a total of 16 miles covered on foot.

American Goshawk, 1; Rough-legged Hawk (sp. ?), 1; Ruffed Grouse, 1; Sharp-tailed Grouse, 6; Gray Partridge, 17 (three flocks); Snowy Owl, 3; Short-eared Owl, 1; Pileated Woodpecker, 1; Hairy Woodpecker, 1; Downy Woodpecker, 1; Blue Jay, 1; Magpie, 10; Long-tailed Chickadee, 5; House Sparrow, 20; Pine Grosbeak, 5; Common Redpoll, 50; Snow Bunting, 100. Total 17, species, 224 individuals. — CAMROSE BIRD CLUB; ROLLY HAWKINS, JIM BUCKINGHAM, DON. MCKINLEY, DAVID AYER, R. CUNDAL, F. L. FARLEY.

RED DEER, ALBERTA, DECEMBER 24, 1935.—The weather on December 24 was rather cold, probably about zero in the morning and a somewhat higher temperature with snow flurries toward evening. Snow from eight to ten inches deep—with a frozen crust due to thawing and rain.

Birds at the feeding-station: Common Pheasant (hen), 1; Northern Hairy Woodpecker, 2; Downy Woodpecker (probably Nelson's), 2; Blue Jay, 4; American Magpie, 5; Long-tailed Chickadee, 15; House Sparrow, 16; Tree Sparrow, 1; Sparrow (unidentified), 1. Other birds observed same day on walk to town at noon. Distance about half a mile. Gray Partridge, 9; House Sparrow, 10; Pine Grosbeak, 6; Redpoll (small, not Hoary, probably Common Redpoll), about 40 (flock).

Total, 12 species, 112 individuals.—M. P. COLE.

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The official publications of THE OTTAWA FIELD-NATURALISTS' CLUB have been issued since 1879. The first were *The Transactions of the Ottawa Field-Naturalists' Club*, 1879-1886, two volumes; the next, *The Ottawa Naturalist*, 1886-1919, thirty-two volumes; and these have been continued by *The Canadian Field-Naturalist* to date. *The Canadian Field-Naturalist* is issued monthly, except for the months of June, July and August. Its scope is the publication of the results of original research in all departments of Natural History.

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The Canadian Field-Naturalist

VOL. L OTTAWA, CANADA, MARCH, 1936 No. 3

SILURIAN ROCKS OF LAKE MEMPHREMAGOG, QUEBEC

By T. H. CLARK

FOR SCENIC splendour there are few spots in Eastern Canada that can compare with the region around Memphremagog Lake. The narrow, twenty-mile lake displays every kind of shore line imaginable; towering cliffs, forested slopes, grasslands and a variety of beaches serve to please every predilection or whim. Trackless woods, mountains, and meadows invite on every hand. A climb to the summit of Owl Head rewards one with a view unsurpassed this side of the Rockies. Sailing, or motor-boating, or canoeing amid such an environment leaves little to be desired.

To the student of nature there is much there to attract, especially for the geologist. Few visitors can escape being impressed to some extent by the rocks thereabouts. The rocky shores invite inspection from the water; lime kilns bear testimony to the recognition and use of local limestone; it is easy to satisfy oneself that such hills as Bear Mountain, Owl Head, and Sugarloaf are there because they are composed of harder rock than that of the surrounding countryside; numerous prospects and the Memphremagog Mine attest the fine tooth combing the rocks have undergone in the search for metallic ores; and, lastly, the lake itself owes its shape and basin to the presence of a long belt of soft rock, which, because it has offered less resistance to weathering and erosion, has been worn down to the trough in which the lake now lies.

It is with these softer rocks that this paper is chiefly concerned. They are conglomerates, sandstones, shales, and limestones of the Silurian and probably Devonian periods.* Their distribution can be seen on the accompanying map. All other rocks in that region are older, and some, especially the slates and crystalline rocks of the Sutton Mountains, have been crushed, folded, and crumpled almost beyond recognition. The rocks of the "mountains", Owl Head, Bear, Hawk, Pevee, Sugarloaf, etc., are all ancient lavas, and antedate by no great margin the sedimentary rocks of the lake basin. In brief the geological history of the region is as follows.

1. Deposition of layers of sandstones, slate, and limestone on the floor of the Cambrian and Ordovician seas.

2. Folding, crushing, and crystallizing of these rocks into the schists of the Sutton Mountains and the black slates of both sides of the lake. This occurred at the close of the Ordovician period, and resulted in the formation of mountains, which, however, were speedily reduced by erosion to a lowland.

3. Pouring out on this lowland (probably in very early Silurian time) of vast amounts of lava, covering the slates. These rocks, being harder than the slates, now stand out in relief, and form the prominent hills on the west side of the lake.

4. Submergence beneath the Silurian and Devonian seas, and the accumulation of a new series of sedimentary rocks, conglomerate, sandstones, shales, and limestones. These were later folded, so that the layers now stand nearly vertical.

Except for the crystalline schists of the Sutton Mountains, there are but three groups of rocks in the Memphremagog region, the older slates, the lavas, and the newer sedimentary rocks. These latter are the ones with which the visitor to Georgeville, to Knowlton Landing, or to Vale Perkins is bound to come into close relation, for these localities are built upon these Silurian and Devonian rocks. It is not possible to describe all localities where they outcrop, so that a brief account of one section in which most of the known varieties occur should serve as a standard of comparison elsewhere.

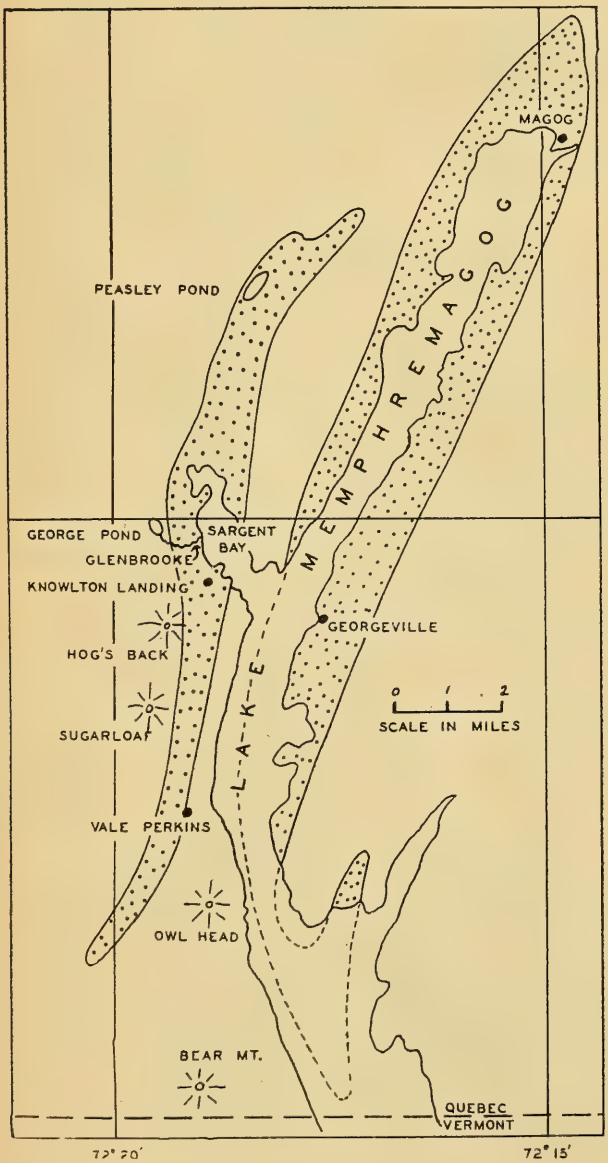
* Published with the permission of the Director, Bureau of Economic Geology, Ottawa.

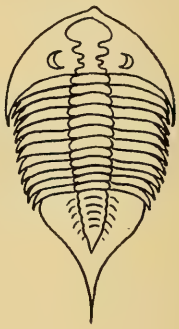
* Robert Harvie published a very brief description of these rocks in the Summary Report of the Geological Survey of Canada for 1913, page 214, published in 1914.

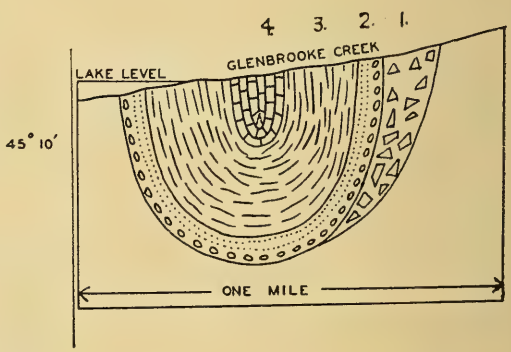
In the town of Bolton, a mile and a half northwest of Knowlton Landing, there is a four-corners, from which a road goes down to the Glenbrooke Hotel, situated on a creek of the same name. Along this creek there is exposed a thick series of sedimentary beds, all vertical, but it can be shown that those to the west were deposited first, and those nearer the lake to have come into being later. Including some rocks best seen along the road to Millington there are four kinds of rocks known. I have called these, in order of age, with the oldest below,

Sargent Bay limestone
Glenbrooke shale
Peasley Pond sandstone and conglomerate
George Pond breccia

GEORGE POND BRECCIA.—The type locality of this most peculiar rock is on the hill just east of George Pond. It consists of a mixture of angular, sub-angular, and rounded blocks of the lava and of earlier slates and quartzites, and of







EXPLANATION OF FIGURES

FIGURE 1. Map of part of Southern Quebec, showing by stippled pattern, the distribution of the rocks described in this article.

FIGURE 2. Dalmanites, one of the types of trilobites to be found in the Glenbrooke shale.

FIGURE 3. Diagrammatic cross-section of the syncline of Silurian rocks near Knowlton Landing. 1. George Pond Breccia; 2. Peasley Pond Conglomerate and Sandstone; 3. Glenbrooke shale; 4. Sargent Bay limestone.

a few other rocks. In general few of the fragments are waterworn, although just north of the four corners mentioned above many seemed to be rolled. The breccia is several hundred feet thick, but of very irregular distribution. Because it is the lowest, that is the oldest, of these sedimentary rocks it lies next to either the lava or the slates, whichever happens to be present. At George Pond it lies next to lava. Its origin is obscure, but it may have been the accumulation of fallen blocks, rubble, etc., at the base of a sea-cliff, some few fragments only having been pounded around by the waves and rounded, or it might have accumulated at the base of an inland cliff, later to be covered by the inundating sea, whose waves would, of course, round off a few boulders here and there without affecting the main mass.

PEASLEY POND CONGLOMERATE AND SANDSTONE. —For half a mile along, and just south of, the road to Millington there can be seen a rather poor development of 140 feet of quartz-pebble conglomerate and sandstone. These beds can be seen to much better advantage at the type section for this formation, along the north shore of Peasley Pond. There, in close juxtaposition to the lava (the breccia being missing), is a thickness of 190 feet of alternating quartz conglomerate and sandstone, with the bedding vertical throughout. There is no reason to doubt the marine origin of this formation, and it is doubtless the material that was washed clean, rolled around, and deposited on the beaches and flats of a sea which in Silurian time began to encroach upon this region. This formation can be seen at dozens of localities between Peasley Pond and Vale Perkins, and its southernmost exposure is about one mile southwest of the latter spot.

GLENBROOKE SHALE.—The sandstone and conglomerate can be seen along the road to the Glenbrooke Hotel. Slightly to the south of these exposures, in the bed of the stream, there begins a shale formation which in places is gritty, in others calcareous, thus bridging the gap between a sandstone and a limestone. This shale continues, with the layers uniformly vertical, for 900 feet downstream, and then gives way to the succeeding formation. The exposures along the stream can be considered the type section. Part way down, at the little flat where is the sugar camp, these shales have yielded fossils of marine animals (mostly trilobites) of Silurian age, thus dating them. Along the shore south of Knowlton Landing these same rocks contain marine corals and other animals, which, when their study is completed, will determine the age of the shales more exactly. These shales are obviously the accumulation of muds in the deepening Silurian sea, and their thickness gives us a measure of the depth to which the countryside was inundated.

SARGENT BAY LIMESTONE. — The Glenbrooke shale grades, with a few alternations, into a fairly pure dark-gray limestone which weathers light gray. This is the limestone which hereabouts has been quarried for lime. It carries few and very poorly preserved fossils, but its gradation with the Glenbrooke shale stamps them both as of the same age. It may be seen in many small and scattered outcrops from Millington southward to Vale Perkins, but it is typically exposed along the lower part of Glenbrooke Creek. The total thickness is unknown but it is at least 290 feet.

GLENBROOKE SECTION.—The section of rocks exposed in the vicinity of Glenbrooke is, then, as follows, with the thickness in feet;

290	Sargent Bay limestone
900	Glenbrooke shale.
140	Peasley Pond sandstone and conglomerate (190 at Peasley Pond).
700	George Pond breccia
2030	

These rocks form the western half of a syncline, the eastern half of which is under water at this place, but can be seen at Knowlton Landing, and thus the complete syncline can be traced. See figure 3. This continues southward beyond Vale Perkins, and finally ends in the Brulée swamp. At hundreds of places on the western side of the lake these Silurian rocks can be seen, and with the standard section in mind they can be interpreted with ease. There are similar and also probably Devonian rocks on the eastern side of the lake, but nowhere are there to be found such remarkably clear and continuous exposures as can be seen in the Glenbrooke section.

FOOD OF THE AMERICAN MERGANSER, (*Mergus merganser americanus*) IN BRITISH COLUMBIA

Paper No. 3

By J. A. MUNRO
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IN TWO earlier papers, (*The Canadian Field-Naturalist*, 46:166-168, 1932, and 48:45-47, 1934), the results obtained from the analyses of 225 stomachs of the American Merganser taken in British Columbia were presented. Since the publication of these papers additional material, comprising 124 stomachs of which 103 contained food, has been studied and the data thus obtained are presented herewith.

As heretofore, officers of the Dominion Department of Fisheries have assisted in this investigation by donating specimens and grateful acknowledgement of their courtesy is extended. Thanks are due also to the Game Commission of British Columbia, to Dr. M. Y. Williams, Dr. C. H. Bastin and Mr. R. A. Cumming of Vancouver and to Mr. P. M. Martin, Langford, British Columbia, for similar co-operation.

The sculpin referred to frequently in the following summary is *Cottus asper* unless otherwise indicated.

Stomach Contents of 61 Specimens from Vancouver Island Including Valdez Island.

GOLDSTREAM

February 12, 1934 (1): Bones of several sculpins; jaw of Salmonidae fingerling, 1 polychaet jaw.

March 28, 1934 (1): 3 sculpins, 2 Salmonidae fry, 1 Salmonidae egg, probably steelhead, *Salmo gairdneri;* a number of earthworms.

COWICHAN RIVER

April 17, 1934 (3): No. 1—sculpin eggs, chief item; Salmonidae fry, probably spring salmon, *Oncorhynchus tschawytscha,* represented by 8 vertebral columns and 12+ jaws. No. 2—vertebral columns of 15 Salmonidae fry; fragments of sea lamprey, *Entosphenus tridentatus,* and sculpins. No. 3—several Salmonidae fry; at least 2 sculpins and a few sculpin eggs.

August 22, 1934 (7): All contained sculpins, the smallest number 2, the greatest 5; one contained a sea lamprey.

October 19, 1934 (2): Both contained Salmonidae fingerlings 15 and 12+; one a sea lamprey, 75 mm. in length.

December 1932-1933 (13): Chum Salmon eggs (*Oncorhynchus keta*) in various stages of decomposition formed the entire contents of 10 stomachs; one contained salmon eggs and a lesser amount of decomposed salmon flesh; in another bone fragments of herring, *Clupea pallasii,* and 2 pairs of polychaet jaws.

January 1934 (4): All contained chum salmon eggs and in one case decomposed salmon flesh.

COLE RIVER

October 18, 1933 (1): At least 6 small Salmonidae.

November 1, 1933 (2): Chum salmon eggs exclusively.

SOOKE LAKE AND SOOKE RIVER

November, December 1934 (5): Kokanees, *Oncorhynchus nerka kennerleyi,* apparently spent fish, in three stomachs; chum salmon eggs in two and a sculpin in one.

COURTENAY RIVER

April, 1934 (14): Ten stomachs contained a total of 20 sculpins; Salmonidae fry or fingerlings occured in two stomachs; insect fragments, chiefly caddis larvae in 7; a small Isopoda in one.

May 4, 1934 (1): Jaws of 6+ Salmonidae fry and insect fragments.

March 9, 1935 (4): Two specimens contained sculpins exclusively, 3 and 8; another 7 sculpins, the chief item; also caddis larvae in cases and crustaceans comprising Amphipoda and Mysidae; the fourth contained broken down salmon flesh, a few salmon eggs and decomposed salmon egg cases.

CAMPBELL RIVER

April 28, 1934 (2): No. 1—2 sculpins; 1 Salmonidae fingerling. No. 2—fragments of sculpin (chief item) and a Salmonidae fingerling.

May 25, 1932 (1): One sculpin 100 mm.; 1 stickleback, *Gasterosteus aculeatus,* 70 mm. and bones representing additional specimens of both fishes.

PORT HARDY

May 9, 1933 (2): One specimen contained 8 Salmonidae, probably spring salmon measuring from 40 to 60 mm.; the other, parts of small fishes including Salmonidae and fragments of Coleoptera.

WHITLEYS LAGOON, ALBERT HEAD

January 27, 1935 (1): At least 4 sculpins, *Leptocottus armatus*, and a few scales of an unidentified fish.

VILLAGE BAY LAKE, VALDEZ ISLAND

October 18, 1934 (1): A large number of fresh water sponge spicules, Porifera, probably *Spongilla* sp. and bones of one or more sticklebacks.

Stomach Contents of 3 Specimens from Tlell River, Graham Island.

April 1, 1934 (2): Bones of at least 8 sculpins, *Myoxocephalus polyacanthocephalus* in one specimen and sculpin eggs exclusively in the second.

May 8, 1934 (1): At least 2 sculpins and 1 Salmonidae fry.

Stomach Contents of 24 Specimens from the Mainland Coast

CAPILANO RIVER

November 1933 (1): Fragments of decomposed salmon flesh and chum salmon eggs.

December 1933 (3): Decomposed chum salmon eggs and in one case broken down salmon flesh.

March 1933 (1): 2 sculpins and bones of several other small Cottidae.

FRASER RIVER NEAR MOUTH

January 11, 1933 (1): A sculpin measuring 175 mm., was lodged in the gullet of this specimen, the preopercular spines having penetrated the neck muscles. This sculpin in turn contained a smaller fish of the same species firmly wedged in the gullet. The merganser was found dead and it seems probable that the sculpin also had died in attempting to ingest a fish too large for its capacity and later was picked up by the merganser. Stomach of the merganser contained bones of at least 2 other sculpins and 2 sea lampreys measuring 30 and 50 mm. respectively.

SEYMOUR RIVER

July 13, 1933 (1): 2 sculpins, 70 and 85 mm., and bones of at least 2 other Cottidae.

PITT RIVER

December 9, 1933 (1): Nearly empty. Bone fragments of an unidentified fish.

SQUAMISH FLATS

November 1934 (1): Chum salmon eggs and decomposed salmon flesh in about equal proportions.

January 20, 1935 (1): 20 chum salmon eggs and a larger bulk of decomposed salmon flesh.

MATHIESON CHANNEL

August 25, 1933 (2): Six small Cottidae in each stomach and scales of a small perch, *Cymatogaster aggregatus* in one.

INGRAM CREEK

June 10, 1933 (1): Bones and eye lenses of at least 7 small marine fishes.

OWIKENO LAKE

May 24, 1933 (2): No. 1—24 Salmonidae fry, 2 sculpins, 1 stickleback. No. 2—vertebral columns 43 Salmonidae fry and caddis larvae in cases.

July 28, 1933 (3): No. 1—caddis larvae in cases and a few unidentified insect fragments. No. 2—6 Salmonidae fry, caddis larvae in cases and unidentified insect fragments. No. 3 — sticklebacks, several Salmonidae fry and fragments of an unidentified fish.

August 2, 1933 (5): These were all juvenals. Sculpins comprised the chief item in each case; caddis larvae also present in four and stickleback bones in one.

BELLA COOLA RIVER

April 10, 1934 (2): No. 1—decomposed fish flesh probably salmon; vertebrae of an unidentified fish and 1 stonefly. No. 2—decomposed salmon eggs exclusively.

Stomach Contents of 11 Specimens from Interior of British Columbia.

SALMON RIVER

September 1933 (1): 60+ seeds, *Cornus (occidentalis?)*, (chief item) and bones of 2 lake shiners, *Richardsonius balteatus.*

KOOTENAY LAKE

August 24, 1933 (1): Bones of 2 chub, *Mylocheilus caurinus.*

BIG SHEEP CREEK

December 1933 (1): At least 1 eastern speckled trout, *Salvelinus fontinalis.*

SOUCHIE CREEK

September 1934 (3): Small fishes exclusively comprising sculpins, small suckers, *Catostomus* sp., and small *Cyprinidae* either lake shiners or squawfish.

MABEL LAKE

August 27, 1934 (1): 3 sculpins measuring 65, 75 and 105 mm., and fragments of several other sculpins.

SKAHA LAKE

August 15, 1934 (1): 2 crawfish, *Potamobius* sp., (chief item); 1 sculpin and bones of 6 small *Cyprinidae* either lake shiners or squawfish.

OKANAGAN LAKE

September 11, 1934 (1): Bones of 2 small suckers, *Catostomus* sp., and small *Cyprinidae*.

OKANAGAN RIVER

September 1934 (2): No. 1—1 sculpin, 4 small *Cyprinidae* and fragments of several crawfish. No. 2—2 crawfish and 1 small sucker.

Food Items Tabulated

Sixty-one specimens from Vancouver Island, including Valdez Island, collected in January, February, April, May, August, October, November and December.

Food Items	No. of Times Found
Salmonidae (Salmo and Oncorhynchus fry and fingerlings)	15
Kokanee—*Oncorhynchus nerka kennerleyi*	3
Decomposed salmon flesh	4
Salmon eggs (chiefly chum salmon, *Oncorhynchus keta*)	21
Herring—*Clupea pallasii*	1
Stickleback—*Gasterosteus aculeatus*	2
Sculpins—*Cottus asper*	24
—*Leptocottus armatus*	1
—*Cottidae* not identified	3
Sculpin eggs—*Cottus asper*	2
Unidentified fish remains	2
Sea lamprey—*Entosphenus tridentatus*	2
Crustaceans—Isopoda, Amphipoda	3
Caddis—Trichoptera (larvae)	6
Fly — Diptera (larva)	1
Beetle—Coleoptera (adult)	3
Aquatic insects—fragments not identified	3
Fresh water sponge—Porifera	1
Earthworm—Oligochaeta	1
Annelid worm—Polychaeta	2

Three Specimens from Tlell River, Queen Charlotte Islands, collected in April and May

Food Items	No. of Times Found
Salmonidae — fry	1
Sculpin—*Cottus asper*	1
—*Myoxocephalus polyacanthocephalus*	1
Sculpin eggs	1

Twenty-five Specimens from the Mainland Coast, collected in January, March, April, May, June, July, August, November and December.

Food Items	No. of Times Found
Salmonidae (Oncorhynchus fry)	5
Salmon eggs chiefly chum salmon—*Oncorhynchus keta*	6
Decomposed salmon flesh	6
Sculpin—*Cottus asper*	8
Cottidae not identified	2
Stickleback—*Gasterosteus aculeatus*	3
Perch—*Cymatogaster aggregatus*	1
Unidentified fish remains	4
Sea lamprey—*Entosphenus tridentatus*	1
Caddis—Trichoptera (larvae)	6
Stone fly—*Perla* sp. (adult)	1

Eleven Specimens from the Interior of British Columbia collected in August, September and December.

Food Items	No. of Times Found
Eastern speckled trout—*Salvelinus fontinalis*	1
Sculpin—*Cottus asper*	5
Sucker—*Catostomus* sp.	4
Lake shiner—*Richardsonius balteatus*	1
Cyprinidae—not identified	6
Chub—*Mylocheilus caurinus*	1
Crawfish—*Potamobius* sp.	4
Dogwood—*Cornus* (*occidentalis?*) fruits	1

In paper No. 2 of this series it was stated that in order to obtain a comprehensive picture of the food chain culminating in the American Merganser, it would be necessary to consider the foods of some of the fish which enter into the food of the duck. Considerable progress has been made in this direction and in a following paper, data concerning the foods of squawfish, whitefish, stickleback, sculpin and ling will be presented.

THE BEAVER OF THE RIDING MOUNTAIN, MANITOBA

AN ECOLOGICAL STUDY AND COMMENTARY

By H. U. GREEN

(*Continued from Page* 23)

FEEDING HABITS AND FOOD SUPPLY

A close study of the beavers' feeding habits reveals that in the spring, summer and autumn they consume a measure of food during the periods of the day they are abroad. On many occasions adult beavers, singly and in pairs, were noticed conveying mouthfuls of succulent plant stems from the edge of the ponds to the lodge, which they either left to float on the water nearby or carried within. Quite often they were observed eating favoured vegetation growing at the water's edge, but nearly always a supply was taken away for future consumption after immediate hunger was satisfied.

As the beavers were never seen actually on land, except between dusk and early dawn I do not think that food plants growing on the

wooded slopes beside the ponds are consumed in the daytime, unless collected under cover of darkness and taken to the lodge. In consequence it may be said that the pond, for the most part, provides the food requirements of the day, and the preferred vegetation of the wooded slopes that which is eaten during the beavers' excursions at night.

Although it is quite evident that the soft bark, tender twigs, and the cambium layer of the Aspen Poplar constitute the bulk of the beaver's winter provender, there was no indication about the ponds under observation (and elsewhere in the Riding Mountain) that the Aspen is preferred during the open months of the year. On the contrary the consumption is limited to the bark and cambium occasionally stripped from the trunks of standing saplings. The wide variety of succulent plants and shrubs growing in and about the water of the ponds offers a selection of stems and leaves which, when available, are favoured in preference to coarser food. Not until early autumn, when sun and frost have withered the annual growth, are the aspen thickets invaded at night and branches conveyed to the pond to provide the food requirements of the day.

At this time the harvesting of winter food begins and, if not too windy and no heavy rain intervenes, continues every night until a sufficient quantity is secured to tide the family over the frigid months. The winter food, however, is not entirely confined to the cambium, tender bark and twigs of the aspen poplar, for a small proportion of willows is also gathered. I have never found any other species of plant life stored for winter food in the Riding Mountain.

The method of storage is both simple and effective. After severing the tops and branches of the felled trees and cutting them into suitable lengths, they are dragged over a selected route, cleared of interfering growth, to the water and towed or pushed to a deep place near the lodge. Willows, collected at the water's edge, are, unless too bulky, removed intact. Branch after branch is heaped one upon the other or entangled beneath the surface until the mass slowly sinks. By the time ice forms only a few twigs can be seen. The aspen trunks are not utilized.

There is seldom a surplus of winter food left over in the spring, and should any remain it is not consumed.

When ice forms on the ponds, food from the storage pile is, of necessity, consumed within the lodge, the beavers gathering what is required from time to time for their immediate use. It would be impossible, though, to convey much of the material inside without reducing it to suitable bulk and length. The heavier sticks, upon being denuded of bark and cambium, are returned to the water and, in the spring, drift down to the dam offering ample evidence that the inmates of the lodge wintered well. It is very probable that the roots of aquatic plants are also secured during the winter months and eagerly devoured.

While there is every reason to believe that aspen twigs and tender willow stems are eaten in their entirety, it may also be possible that sometimes coarse wood is consumed. I have seven records of the total absence of chips about stumps of beaver cut aspen saplings from 1 to 2 inches in diameter, and three records of narrow scarves cut in felled trees of the same species 3.5, 4.9 and 4.7 inches in diameter. The tooth marks in every instance were those of adult beavers. I can offer no other explanation for their absence, as wood chips appear to serve no other useful purpose.

The distance travelled on land to secure food and building material is limited. Both at Sites Nos. 1 and 2 (and other beaver locations in the Riding Mountain) there is evidence of the abandonment of aspen areas in favour of new stands closer to the ponds when the former are cut back about 75 yards. Signs of beaver industry about inhabited ponds were never encountered at a greater distance. This, however, does not refer to migratory habits.

The following seasonal list of food plants favoured by the beavers under observation was compiled from the evidence afforded by characteristic signs and tooth marks on trees and shrubs cut and denuded of foliage, direct observation, and specimens collected from within the lodges through a small hole made for this and other purposes in connection with the study. The list in respect to small plants must be considered incomplete.

Typical beaver lumbering area. Note that the smaller wood is all removed for food and building material.

Beaver-made canal connecting the path from the lumbering area with the pond. Site No. 2.

Photographs by H. U. Green.

SPRING AND SUMMER

Fragaria virginiana	Strawberry	Leaves and fruit.
Mentha sp.	Mint	Leaves and stems.
Nymphaea microphylla	Spatterdock	Roots.
Populus tremuloides	Aspen Poplar	Bark and cambium from standing trees.
Rosa blanda	Wild Rose	Leaves and fruit.
Rosa nitida	"	
Rubus idaeus	Raspberry	Leaves and fruit.
Salix longifolia	Willow	Leaves, tender growth, bark, and cambium.
Salix lucida	"	
Salix pedicellaris	"	
Spartina michauxina	Slough Grass	Tender part of stems.
Stellaria borealis	Chick Weed	Foliage and roots.
Typha latifolia	Cat-tail	Tender stems.

AUTUMN (AFTER FROST)

Populus tremuloides	Aspen Poplar	Tender bark, cambium, leaves, and twigs.
Nymphaea microphylla	Spatterdock	Roots.
Salix longifolia	Willow	Bark, leaves, and twigs.

WINTER

Populus tremuloides	Aspen Poplar	Tender bark, cambium, and twigs.
Salix longifolia	Willow	Bark, cambium, and twigs.
Salix pedicellaris	Willow	Bark, cambium, and twigs.

Although aspen poplar is the dominant growth about the ponds under observation and other beaver sites, occupied or otherwise, in the Riding Mountain, White Spruce, (*Picea canadensis*) Tamarac, (*Larix laracina*) White Birch, (*Betula pendula*) and Balsam Poplar (*Populus balsamifera*) also occur, but there is no evidence to indicate that they are used for food or any other purpose. I have, however, one record of an exposed lateral root of a white spruce which showed signs of having been stripped by a beaver. It is doubtful, though, if any of the bark was consumed or carried away, as the bulk of the parings lay beside the root. What little impression the teeth left suggested the work of a young beaver who was probably playing or wearing down its incisors. Neither is there any evidence that anything other than vegetation is favoured by beavers for food.

At Site No. 1, I was in the habit of leaving apples, carrots, and bread, beside the lodge and watching the result from cover a few yards away. For some time these delicacies were ignored, but finally they were accepted and quickly devoured on the spot. When placed together, the apples were always eaten first, followed by the carrots, and lastly the bread. It did one good to see how they mouthed the unusual food with every sign of enjoyment.

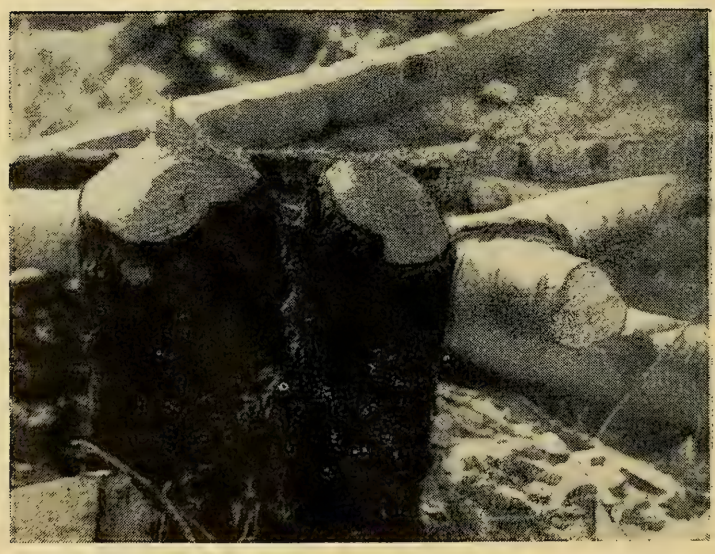
Apart from the satisfaction derived from feeding this family of beavers, I have been impressed by the possibility of reducing certain other families in the Riding Mountain to a state of semi-domesticity, so that naturalists and visitors to the park could obtain first-hand knowledge of this wonderful mammal in a natural environment without encountering the many perversions which tame beaver acquire through too close contact with humans.

Beside using their "hands" to pick up food from an upright position and convey it to the mouth in typical rodent manner, beavers also use their "hands" individually to pluck leaves from aspen branches and other light vegetation while on all fours. Bark and cambium from aspen limbs, too heavy or awkward to lift, is peeled where it is and eaten forthwith in the process. Bark and cambium from standing trees may be peeled while on all fours, but it is generally stripped while standing.

I have never observed beavers eating while floating on the surface or in swimming water. Food secured in the pond is either taken to the nearest shallows and consumed, or conveyed to the lodge.

The peculiar habit of sitting on the tail while eating in an upright position is very noticeable. Standing for a moment on one hind leg, the

The path continues down the steep slope to the landing place and canal.



Twin stumps with upper portion of another tree lying nearby, severed to secure the leafy branches and small wood from the crown.

Photographs by H. U. Green.

other is raised and the tail brought to the front with a sweeping motion and promptly sat on. The upright posture is perhaps more comfortable with the tail in this position.

LUMBERING AND ASSOCIATED ACTIVITY

The most interesting phase of beaver activity is the felling of trees. In this, and other wonderful work the beaver performs, a high degree of intelligence is apparent, surpassing that of any other forest mammal.

The following is my conception of the procedure, determined from the evidence offered by many aspen trees in various stages of decapitation, and from visual observation when intensive lumbering was undertaken by the occupants of the several ponds:

Assuming an erect posture beside a selected tree with tail extended as a brace against the exertion of muscular jaws and "arms" clasped about or against the trunk, two horizontal furrows are made above and below shoulder height, about a quarter of an inch deep and from three to four inches apart. The intervening material is then pried out in the form of a large chip. Other chips are removed to the right and left in like manner, and as the resulting scarf is cut deeper into the trunk additional material is taken from the upper and lower faces to permit the beaver to labour more expediently. Continuing the operation, the upper and lower margins of the scarf are cut wider apart and the faces narrow up and down past the centre of the tree until over two-thirds of the diameter is severed. Up to this time, the part of the trunk directly opposite to where the beaver began its work, is untouched. This unsevered portion is always attacked last and the material removed from each side at right angles to the beaver's original position until the trunk is completely girdled and only a small shaft of wood connects the tree proper to the stump. When the operation is finished, the scarf cut from the sides of the trunk, to the right and left of the beaver's original position is, generally, not only smaller than the main scarf, but much higher and more narrow. Therefore, the lower face of the main scarf presents a less acute angle than the upper face. However, slight variations in technique are evident from time to time.

No attempt is made to sever the small shaft of wood connecting the tree proper to the stump and, in consequence, several minutes may elapse before the tree crashes to the ground. This would appear to indicate, as the shaft has considerable strength, that it is deliberately left at a certain thickness as a protective measure to create a lag in the fall, and to offset the possibility of the butt "jumping" when the tree strikes the ground, as almost invariably the trunk and stump remain connected by tenacious slivers. Thus, the beaver has ample time to leave the danger zone with a generous margin of safety.

There is no reason ever to suppose that a tree is felled by working in circles round the trunk, or that beavers "worry" through the trunk by gnawing. The presence of chips up to four inches long, one and a half inches wide, and over a quarter of an inch thick, becoming smaller as the scarf narrows, at once dispels the thought as upon serious investigation many other fallacious beaver attributes fall from the pedestal of imagination.

When cutting a standing tree, the beaver's head is turned sharply sideways, simulating as closely as possible the natural working position assumed while severing limbs and branches on the ground. Willow stems and aspen twigs up to half an inch in diameter are severed with one bite and the cut surfaces are angular. Heavier limbs, lying on the ground, are scarfed in the same manner as a standing tree, with the exception, of course, that the work is performed entirely from the upper side with the head in a natural position.

An examination of beaver-cut areas about the ponds under observation, and elsewhere in the Riding Mountain, reveals that lumbering operations are, for the most part, pursued on the slopes and slanting benches close to the water's edge. Consequently, there is a marked tendency for trees growing thereon to lean towards the downward incline and, assisted by the manner of scarfing, which is always done from the higher side of the slope, fall in the direction of the water when severed near the roots.

The direction in which a beaver-cut tree will fall, even without the assistance of a natural lean is, with few exceptions, away from the widest part of the scarf within an angle of 70 degrees to the right and left of the centre of the stump, and so, unless deterring influences intervene, or the technique varies slightly from established form, is determined by the position the beaver assumes during the first part of the operation.

This contention is supported by the following summary resulting from a careful study of 207 beaver-felled aspens selected at random about the sites under observation:

Falling directly away from widest part of scarf within 10 degrees to the right and left of stump centre:	47
To the right, within an angle of from 10 to 70 degrees:	75
To the left, within an angle of from 10 to 70 degrees:	73
To the right or left, within an angle of from 70 to 90 degrees:	4
Falling directly towards the widest part of scarf, within 10 degrees to the right and left of stump centre:	1
To the right, within an angle of from 10 to 70 degrees:	4
To the left, within an angle of from 10 to 70 degrees:	3
To the right or left within an angle of from 70 to 90 degrees:	Nil.

There is also evidence to support the belief that the beavers knowingly take up a position when commencing to fell a tree which is advantageous to them. For instance, when aspen areas on level and comparatively level ground are first invaded, the initial scarf cut in the trees on the margin of the stand is on the inside, and they fall outwards into the clear. If the reverse were the case they would fall inwards and probably entangle with standing trees. However, when a space is partially cleared, the trees may fall in any direction depending, for the most part, on the position of the main scarf, which is then given scant consideration. The same procedure is adopted when invading new aspen areas on slopes and slanting benches; the outside trees are cut first, falling into the clear as the beavers work upward and backward.

Fouled trees are seldom encountered among stands of aspen growing upon an incline. The lean of the trees and the influences assisting the direction of fall, prevent the possibility to a marked degree. This is not the case on level, and comparatively level ground, for such accidents sometimes occur after a space is partially cleared of trees. For the most part, though, the labour and material are not lost, as the entangling tree is eventually felled, or the entangled one released by heavy winds. I do not wish to infer that an entangling tree is cut down with the deliberate intention of permitting an entangled one to fall, but rather that this happens in the ordinary course of events. Should, however, the branches of a cut tree within a lumbering area foul another standing on the border beyond, the entangling tree is never felled, unless the area is extended and it comes directly within the sphere of the beavers' later activity.

When endeavouring to arrive at some conclusion as to whether or not beavers can, with a degree of forethought, drop a tree in a desired direction, I quite realize that I am on the threshold of a much discussed psychological problem, and that the individual who entertains the idea of the feat bordering upon the realms of possibility, opens wide the doors of derision. However, I would feel that my study is incomplete did I not offer an opinion based upon my observations which suggest, I think, a compromise with existing thought.

Considering first the sloping aspen areas, the general rule that a beaver-cut tree falls away from the widest part of the scarf, offers little evidence unless we know why they work on the higher side of the incline. Do they assume this position without realizing the assistance of the slope because it is the easiest side of the tree to work, or is the position chosen with premeditated intent without thought of comfo.t?

Applying the rule to aspen areas on level and comparatively level ground, we find that the outside trees fall outward into the clear, and not until a place within the stand is cut over is the direction of fall more or less haphazard. I am inclined to believe that the obvious intelligence responsible for the technique employed on level and comparatively level ground can be logically applied to the manner of the beaver's lumbering on slopes and inclined benches, for the reason that although the higher side of the slope or incline is undoubtedly the most comfortable and expedient place to work, it merely happens that it offers a fortuitous combination of comfort and correct position to attain a desired end.

I think, from what I have learned, that I can justly infer, without finality or fear of ridicule, that while a beaver may not, with direct premeditation, drop a tree in a predetermined position it is, nevertheless, conscious of the general directon in which it will fall, and thus, barring difficulties it can not foresee or understand, realizes in a general way the cause and effect of its endeavours. Faulty technique may be ascribed to lack of individual skill and, perhaps, to a lesser degree of intelligence. In any event, one could naturally expect variations of both, as individualism among mammals is not confined to the human race. There are many things undreamt of in a true philosophy of the wilderness incapable of proof by laboratory methods and study under unnatural conditions.

It is evident that the extent of lumbering activity within a given area is not regulated by

the number of available trees, but rather by the distance from water, which increases as the cutting is extended farther from the pond. When the distance becomes too inconvenient or dangerous to warrant further work, a new stand is invaded. No deserted areas were observed exceeding one acre in extent, and many measure only a few square rods, depending upon surrounding associations.

Aspens growing beside beaver ponds in the Riding Mountain seldom exceed 10 inches in diameter, and so I am unable to say how large a tree beavers would fell if afforded the opportunity. I have never observed a neglected tree up to and slightly exceeding this size, for if it is green it is favoured, irrespective of diameter. Thus, the space within lumbering areas is cleared to the last living tree.

Lumbering, especially in the autumn, when winter food is being harvested and sticks and stems gathered to fortify the lodge against the ravages of winter, is not a haphazard venture but a project undertaken with preparation, deliberation, and foresight. The amount of material required varies, of course, according to circumstances. During the summer months the demand for sticks for minor repairs to the dam is small, consequently they are usually gathered from the willow clumps in and about the ponds without organized effort.

In an endeavour to describe the lumbering activities of the beaver of the Riding Mountain graphically, I am recording in detail the work performed at Site No. 2 during the autumn of 1933, not because it differs from the other ponds under observation, but for the reason that the environment demanded greater effort to accomplish the desired end. The pond, it may be said, was uninhabited by beavers from the spring of 1932 until I introduced a two-year-old pair in June, 1933. Therefore, there was more than the usual deterioration of dam and lodge which, however, was partially taken care of before the autumn work commenced.

For several years the autumn cut of aspens for winter food and building material at Site No. 2 has been taken from a comparatively level bench 50 yards in a direct line from the pond and 63 yards by way of a beaver-made path through the underbrush to the head of a beaver-made canal dug slightly into the bank and extending some 20 yards through a willow swamp to the open water of the pond. From the canal head to the margin of the bench, 59 feet above the level of the pond, the path inclines sharply upwards until the margin of the cutting area is reached, where it ceases abruptly.

It was not strange that the introduced pair should profit by the labour of their predecessors and use the canal and path to the aspen stand. This they did within a week after being placed in their ready made home, to gather material to repair the lodge and dam.

The actual autumn work was first in evidence on the morning following the night of September 6th, when two aspens, 3.5 and 4 inches in diameter were felled and the limbs severed from the trunks. The limbs, minus the leafy twigs, were dragged down the path and through the canal to the pond. The material was used during the night of September 7th for building up the spillway of the dam. The aspen stand was also visited and the leafy twigs, left the previous night, removed to the water beside the lodge. During the night of September 8th, which was very windy, no cutting was done in the aspen stand, but 13 green willow stems were harvested in a thicket close beside the pond and added to the limbs already placed on the spillway of the dam.

No further activity was noted until the morning of September 11th, when it was found that three more aspens 2.5; 2.8; and 3.9 inches in diameter, had been felled and the branches and leafy twigs taken to the pond and left beside the lodge. This, I believe, was the initial contribution to the winter food pile. When visiting the site on September 12th, an additional felled aspen 4.9 inches in diameter, was observed. The branches were taken to the food pile. A smaller aspen, 3.5 inches in diameter, was also severed, but in falling fouled another tree.

I left Site No. 2 on September 12th and did not return until September 23rd. In the meantime the branches of seven felled aspens had been removed from the stand, including those from the fouled aspen since released from the entangling tree, probably by wind, and an undetermined number of willows cut beside the pond. Previously the naked trunks were not utilized. Now it was evident that the tops of six had been severed, placed on the sides of the lodge and imbedded in mud. Willows, too, were loosely stacked about the apex. The food pile, which on September 11th consisted of a few leafy branches of aspen, now reached considerable size, and all the material, with a small proportion of willow stems, was now be-

low the water. The aspens felled between September 12th and September 23rd measured 7; 6.5; 6; 5.3; 5.2; and 3.4 inches in diameter. On the night of September 24th, one aspen 5.2 inches in diameter, was felled and the branches removed. The top was also severed, but could not be traced. After the night of September 24th, there was no evidence that the aspen stand was again invaded. Willows, however, were cut in small quantities. By September 27th all lumbering activity evidently ceased and the beavers settled down to await the advent of winter.

The lumbering activity of the two beavers at Site No. 2 during the autumn of 1933 totalled 14 aspens, the branches of which were conveyed to the pond via the path and canal; the naked tops of 7 of these trees, removed by the same route, and a quantity of willow stems. The amount harvested slightly exceeded the average at the sites under observation. The usual autumn cut at these locations during the period of investigation averaged 10 aspens of about the same average diameter and a similar quantity of willows.

Dead trees and those showing obvious signs of advanced decay are never felled, neither are any portions of felled trees from which the branches have been severed, utilized, other than the slender tops. Consequently, at all beaver sites in the Riding Mountain, cut-over areas are littered with dry and decaying trunks, the soundest of which are often hauled away for firewood by settlers from the surrounding district.

There is no evidence to suggest that any other species of trees or shrubs beside aspen and willow are used for any purpose by the beavers as constructional material.

Although every effort was made to ascertain the time taken by the beavers to fell a tree, no information of any value could be secured. The difficulty of approaching the vicinity of the ponds when the beavers were working on land, even under favourable wind conditions, is always complicated by the presence of intervening trees and the beaver's extreme caution when away from its natural element. Any suspicious noise or a breath of alien odour is sufficient incentive for work suddenly to cease, often not to be resumed that night. I have, however, on moonlight nights been fortunate enough to glimpse dusky shapes labouring among the aspens, busily engaged felling trees, severing branches, and dragging them to the water, but it was always a case of the ear assisting the eye to know exactly what was going on.

I am unable to offer any information regarding whether beavers work in pairs when felling trees. My opinion is that it is an individual operation. However, once the tree is down team work is evident to remove the branches and convey them to the pond.

Repairs to the lodge and dam are performed with less caution and during twilight. The beavers at the sites under observation were often seen during the autumn, plastering and building up these structures with muck and sticks. The muck is usually secured from the bottom of the pond, but quite often from the neighbouring shallows. It is carried clasped tight with the "hands" to the beaver's breast which, when on land, means that the animal walks on its hind legs, balanced by the tail.

At this time sticks are gathered from the nearest willows, or branches taken from a supply recently brought to the water when lumbering operations were in full swing. Sticks and branches that happen to be of a length unsuitable to the beaver's needs are either cut on the incline of the lodge or crest of the dam, as the case may be, never in the water.

The method of handling long sections of material brought to the dam or lodge to be utilized for construction purposes or repairs is interesting, and indicates a degree of perception in order to avoid unnecessary exertion incidental to dragging an awkward load up steep banks or inclines. The technique employed is similar to the manner in which a human being would work under like cirsumstances, except, with the beaver, teeth are substituted for hands. Arriving at the water's edge with the material in tow, the beaver emerges and places the end of the stick or limb on land. It is then skidded up the slope a few inches by a side movement of the beaver's head. A fresh hold below is then taken, and the operation repeated until the load is clear of the water and either located in a permanent position, or placed where it can, if necessary, be conveniently severed. Shorter material of less weight is dragged directly from the water to wherever desired. To move heavy sections of aspen and small severed trees cleared of branches, the weight of the body using the shoulders or breast as the point of contact, is employed. The tail assists as a brace. I do not think, though, that this method of moving material is applied, except to shift heavy and unwanted pieces out of the way.

Aspen poplar. Note the lateral tooth grooves in this and succeeding photographs showing that the beaver's head is held sideways while scarfing a standing tree.

The crown of this aspen poplar became entangled in the branches of a nearby tree. It fell some days later.

Photographs by H. U. Green.

Mention has been made of beaver paths, and as they are also associated with lumbering activity they may, at this time, be described and discussed.

My observations indicate that the making of a path is the first consideration after a cutting area is selected, for otherwise it would be impossible to remove material from elevated benches to the water owing to interfering growth. Aspen stands situated immediately beside the ponds seldom present any difficulty, especially when close to the water. In this case, the use of prepared and well-defined routes is seldom necessary.

When clearing a path the vegetation is removed to a width of from four to five feet and the length determined with due consideration to an unnecessary distance intervening between the canal, or the water's edge, and the margin of the selected stand. Should a windfall tree lying close to the ground be encountered, the part forming the obstruction is cleared away, unless it is posible to remove the tree in its entirety. On the other hand, if sufficient space beneath the obstruction permits the passage of branches without fear of entanglement, the path passes underneath. When stumps occur, singly or together, a detour is invariably made.

After a lumbering area is extensively cut over, it often happens that the head of the original path becomes too far removed for convenience. Should this occur and the stand is not abandoned, a new path is prepared if the working location is closer to the pond by another route. My contentions are based upon observations made at Site No. 2, where a change of route was deemed advisable during the harvesting operations of 1930. For some reason which I was unable to determine, the new, or second path, was neglected in favour of the original route by the beavers introduced to the pond in 1933.

When an inclined beaver path exists beside the water's edge or, as at Site No. 2, at the head of the canal, it is believed locally that the beavers keep it in a wet state when harvesting operations are in full swing, for the purpose of aiding the descent of material en route from the cutting stand to the pond. How the water is conveyed from the pond to the inclined path, is not disclosed! I think, however, that the belief arises from the fact that dripping bodies emerging from the pond naturally keep the landing place and the immediate vicinity in a muddy condition. There is usually an explanation for ill-considered local lore.

PONDS

The discovery of an inhabited beaver pond is like finding an unknown family in the forest. The dam, the lodge, and other evidence of a wide understanding necessary to make the valley of a small stream a habitable place in which to live through the years, cannot fail to excite the admiration of every enquiring mind. To work with sympathy, yet with scientific exactitude, seeking to recognize the beavers' works and ways, is to be impressed that something beyond mere instinct, specialized though it may be, enables them to accomplish feats of engineering skill that are the wonder of mankind.

Well I remember the day in August, 1929, when exploring the valley of the Vermilion River for signs of beaver and wapiti. Many old dams and lodges had been investigated and photographed. Then, near evening, almost at the moment I began to retrace my steps toward the Dauphin — Clear Lake road and home, the resounding slap of a beaver tail on the surface of the water, caught my ear. It seemed too good to be true. Within a week three inhabited beaver ponds had been found a stone's throw from a passable road thirty miles from home, and near a comfortable cabin which later became the base for beaver and wapiti investigation.

But for the discovery of these inhabited ponds my study would have been impossible. And, as they are directly connected with the beavers under observation, they alone have been selected for description. Each is representative of ponds which exist, and have existed, elsewhere in the Riding Mountain. As previously stated they received their identification as Sites Nos. 1, 2 and 3.

Site No. 1 is situated in a beautiful location between heavily wooded slopes of aspen poplar, interspersed with an occasional white spruce. Almost a mile in length, with an extreme width of 137 feet, the pond is the largest inhabited beaver site I have found in the Riding Mountain. Through its entire stretch the well-defined submerged channel of the Vermilion flows, entering the pond by way of a narrow gorge, beyond which the Kennice Meadow lies in a deep forest-fringed basin approximately a quarter of a mile wide and over a mile long. The Kennice Meadow is flooded in the spring and early summer by backed-up water from the pond. At the

Beaver-cut trees are sometimes hung up. This aspen poplar fouled another on the edge of the stand.

Game trail beside the lower pond at Site No. 2 used on occasion by the beavers to cross a bend in the Vermilion River.

Photographs by H. U. Green.

gorge, the Vermilion is within a mile of its source,—a number of small overflowing springs. The springs and the natural drainage from the Kennice Meadow basin provide the water supply for the pond, which often fluctuates during the summer months depending upon the amount of local precipitation.

The deepest part of the pond is the submerged river channel, where depths of from 6 to 8 feet have been recorded within 300 feet of the dam. Towards the gorge, the channel has evidently silted up, as only from 3 to 5 feet of water is general at normal pond level. Near the dam, several water-killed aspen poplars and small white spruce stand stark and grey amid broken stumps protruding a few feet above the surface, creating anchorage for rafts of pond weed floating at the whim of every changing breeze. Towards the Kennice Meadow basin the shores are flanked with tules, sedges, cat-tails and lush vegetation, and here and there lily pads blotch the surface of sheltered coves. Many mallard and pin-tail ducks hatch broods of fluffy youngsters among the grass near the shallows, finding enjoyment and sanctuary where the sound of guns is never heard. In the spring and fall, flights of migrant waterfowl dip to the surface to rest while pursuing a hurried way to or from the breeding areas of the north. For several years a solitary bittern has built her nest in the rank vegetation below the dam. Muskrats too, and even tiny fish, profit by the beavers' labour which, in truth, has created a generous environment for many creatures. And so, in the basin of the Kennice Meadow, marsh grass grows where, but for the beaver pond, there would be little available to winter herds of hungry wapiti and provide tender forage and water during the heat of summer days. To me there is an indescribable something about this pretty location always so tranquil amid the sheltering trees, except for an eternal breeze moaning through the valley when all else is still. Not a mar or scar of human origin is near to dispel the thought that a hundred, yes, a thousand years, could have witnessed what one sees to-day.

The pond at Site No. 2, situated in the same valley two miles below Site No. 1, is bare and drab in comparison, and entirely different in character and surroundings. Only the south bank is treed with aspen poplars and a few white spruce. The north bank is bare, lined with game trails, and strewn with many boulders of limestone, granite, and gneiss. It forms the southern border of the Kennice Plains, a semi-open area of aspen poplar and willow growth, intersected by shallow ravines.

Site No. 2 is in reality two ponds, separated by a short stretch of the river's course. The upper pond, 158 feet across at its widest part, terminates 607 feet above the dam and spreads out to create a soggy marsh filled with niggerheads and willow clumps through which the river overflows. The lower pond is 105 feet wide and approximately 160 feet long, almost clear of obstructions with the exception of a few water-killed willows near the water's edge. In this respect it is similar to the upper pond. As near as I was able to ascertain, the surface of the lower pond at the time of calculation was about 7 feet below the surface of the upper one.

Although nearly sufficient river water is restrained at the time of the spring freshets and summer rains to keep the ponds full, neither is entirely dependent upon these sources of supply, for both are generously fed by several springs which, except during severe winter weather, flow throughout the year. For this reason the ponds, barring damage to the dams, are always brim full. In this respect they differ slightly from Site No. 1, for although the pond at this location is in a measure also spring fed, the distance from the source of supply precludes the possibility of receiving more than a small percentage of the output. Thus it was found that the level of Site No. 1 during the summer months was below normal when the ponds at Site No. 2 were full. The lower pond at Site No. 2 in addition receives the overflow from the upper pond.

The deepest part of the upper pond at Site No. 2, as at Site No. 1, is the submerged channel of the river, where a depth of 6′ 8″ has been recorded, and in the lower pond, the deepest place found, in this instance near the south bank, was 5′ 6″. Both ponds fill the valley from bank to bank. A strip of willow growth, however, intervenes between the two, broken by the river's course.

Site No. 3 is situated in the valley of Spruce Creek, a tributary stream of the Vermilion River, which is joins a little over a mile away. The location is somewhat similar to Site No. 1, except that the valley is deeper, of greater width, and more heavily wooded with aspen poplar. An ever-flowing spring, the source of Spruce Creek, one and a half miles above the pond, ensures a constant water supply during the open seasons, even in the driest years. Only

Beaver landing place in upper pond at Site No. 2. No paths lead away to the vicinity.

Photograph by H. U. Green.

in very severe winter weather is the output subdued. Generally the creek is found flowing beneath shelving sheets of ice when the temperature is low. When the winter is comparatively mild, or constantly broken by periods of warm weather, the water may reach the pond. This occurred on several occasions during the winter of 1930-1931. In the spring, freshets of melted snow and rain come tumbling down the creek, quickly filling the pond if the supply from the spring has been negligent during the winter months or much leakage to the dam has inadvertently occurred.

The greatest width of the pond at Site No. 3 is 156 feet, and the length about 750 feet. The extreme depth at normal water level was found to be 6′ 5″. Little or no lush grass grows about the water's edge, except towards the upper reaches, which spread out to the right and left of the pond proper to form a small marsh. Cattails and sedges are entirely absent, but many willows flourish beside the banks, and water-killed clumps almost obscure the site from view.

Throughout the length of the pond no definite creek channel could be located, which led me to believe that it has long since silted up level with the submerged banks.

The locality is pervaded with an atmsophere of extreme loneliness. For want of shelter and lack of suitable nesting sites no waterfowl frequent the pond, and, except for evidence of beaver activity, not a sign of animal life is visible in the surrounding forest. To be sure a game trail here and there follows the slopes of the valley, but for some reason best known to themselves passing animals decline to drink from the pond, sweet and fresh though it is. As at Site No. 1, an eternal breeze moans through the valley when the forest above gives no hint of wind. No wonder the local Indians believe the Riding Mountain to be the abode of evil spirits, for many times, especially at night, I have been tempted to think so myself.

About the banks of each pond there are several recognized landing places used by the beavers when leaving the water for their excursions on land. These were never found in exposed positions. They are invariably well sheltered by shrubs and bushes and usually connected with the pond by a short canal cut into the bank, filled with water of swimming depth. From the head of each canal well worn paths are in evidence, leading to places a short distance away where favoured food can be found. The paths have no connection whatever with lumbering activities in a general sense. These were found to be separate and distinct in the localities under observation and used for no purpose other than to convey the harvest of winter food to the pond and to secure material for building and repairs. At each pond, too. one or more places were observed indicating that the beavers left the water without proceeding further on

land,—much frequented, usually wet, and smelling strongly of urine and possibly castoreum. Reference has been previously made to this observation.

It is a rather significant fact that, with few exceptions, all the beaver ponds in the Riding Mountain surveyed by myself depended to a great extent on the output of nearby springs for a water supply. Thus it would seem that the beavers when seeking a location to build a home give as much consideration to this very desirable attribute as to the presence of a generous food supply. Without a constant addition of water to the pond it is very doubtful whether the occupants could exist with any degree of certainty from year to year, for while freshets give sufficient depth during the early part of the open season the streams often cease running throughout their course by midsummer. The necessity of a water supply not entirely dependent upon precipitation to replace evaporation and the large quantity consumed by game animals is of vital importance when it is realized that deep water is essential for winter survival. Should the pond be of insufficient depth near the lodge the winter food supply would be frozen in and in all probability the beavers, imprisoned beneath the ice, would perish from starvation. To rely upon autumn rains to brim the ponds is to flirt with disaster. In consequence I am led to believe that the selection of locations for home building near where springs exist is not a random choice, but an intelligent decision.

The depth of ice that will form on a beaver pond (as in water elsewhere) depends not only upon low temperatures, but is governed in no small degree by the amount of snow, which acts as a protective blanket on the ice surface. The heavier the snowfall the thinner the ice. This is particularly noticeable if, soon after freeze-up, a heavy fall occurs. When this happens the ice never attains the same thickness as it would if heavy snow fell later in the season.

Sometimes during the winter a small leak will occur in the retaining dam and the water beneath the ice is slightly lowered, thus creating an air space between the ice and the water. In this case the ice above is prevented from attaining additional depth. The water beneath, however, eventually freezes over. To what extent beavers take advantage of an air space, I cannot say, but there seems no doubt that a wonderful opportunity would present itself to swim about with their heads above water until ice formed. A subsequent chapter relates how otters breached a beaver dam presumably for the purpose of creating an air space beneath the ice in order to fish in the pond.

The following is a comparative table of the depth of ice and snow on the ponds under observation recorded in the month of January during the winter seasons 1930-1931 and 1931-1932:

	1930-1931		1931-1932	
	SNOW	ICE	SNOW	ICE
Site No. 1	4″	20″	22″	16″
Site No. 2		–		
Upper pond ...	4.5″	21″	23″	16.5″
Site No. 2				
Lower pond	4.7″	20.5″	23″	17″
Site No. 3	5″	22″	25″	19″

The age of the ponds at Sites Nos. 1, 2, and 3, is questionable. All, though, are many years old, judging from the appearance of the dams and cut-over areas thereabouts.

No mention has been made of the beaver of the Riding Mountain inhabiting lakes, for the reason that to date there is no evidence that would show that they have ever favoured large bodies of water in preference to ponds of their own creation. They are "creek" beavers if one may use a coined term of differentiation.

(To be continued)

LAND SHELLS OF BIG ISLAND, BLUE SEA LAKE, QUEBEC

By A. LA ROCQUE

DURING a short stay at Blue Sea Lake, Quebec, in September, 1933, I obtained a small collection of shells from Big Island, together with a quantity of moss which was brought in for later examination. Fresh-water shells from Blue Sea Lake, Ellard Creek and Grant Lake were also obtained and will be discussed in a separate paper.

The following shells were obtained under logs, dead leaves, stones, etc.:

Haplotrema concavum minus Ancey—3 living specimens.

Polygyra monodon cava (Say)—1 dead specimen.

Discus cronkhitei anthonyi (Pils.)—3 living specimens.

Strobilops labyrinthica (Say)—1 specimen.

Retinella sp.? 5 specimens, immature.

Zonitoides? sp. 5 specimens, immature.

The moss obtained was dried, shredded and sieved, after which it was examined, a small quantity at a time, for shells. The following species were separated and identified:

Striatura exigua (Stimpson).

Striatura ferrea Morse.

Striatura milium Morse.

Punctum pygmaeum (Draparnaud)

Strobilops labyrinthica (Say) young.

Vertigo spp. (perhaps 3 species; only one of each, poor specimens.)

Zonitoides sp. (young).

All the shells above are listed for the Ottawa district and have been collected from moss by Latchford. The present record extends their range ninety miles to the north of Ottawa and points to their probable presence as far north as moss can be found. It is to be noted, however, that not all kinds of moss harbour shells. *Sphagnum* moss from Mer Bleue, examined by Mr. Fairbairn, was entirely devoid of shells. Certain other kinds of moss from the Ottawa district were also unproductive, but it is not yet possible to say whether this was due to the position of the moss or to its generic or specific identity. There is here an interesting field of study which the writer hopes to investigate more fully in the future.

Lasmigona compressa (Lea) IN THE HUDSON BAY DRAINAGE

By A. LA ROCQUE

SIMPSON[1] records the range of *Lasmigona compressa* (Lea) as follows: "Ohio and St. Lawrence drainage areas; west to Nebraska, north through eastern Iowa to Wisconsin; Hudson River," and for the variety *plebeia* (C. B. Adams) gives the following: "Vermont; Montreal River; Lake Superior". Whiteaves in 1895[2] had already recorded the species for the Hudson Bay drainage on the strength of one valve collected by Robert Bell in the Boulder River, one of the upper branches of the Attawapiskat, and this was confirmed by Latchford[3] who obtained specimens from the Missinaibi River, 20 miles east of Hearst, Ontario. Latchford's paper was published after Simpson's Catalogue but why Simpson did not accept Whiteaves' record is difficult to understand, especially since Whiteaves' paper recording *Lasmigona compressa* for Boulder River appears in the bibliography of the 1900 Synopsis. The specimen on which Whiteaves based his record is in the National Museum of Canada (Mollusca No. 2427) and is correctly identified. The shell itself is marked in pencil "Boulder River, 1886, R. Bell" and there is no reason to doubt the locality.

In the course of field work for the Geological Survey in 1935, Dr. R. T. D. Wickenden collected a few specimens of Naiades from the Carrot River, Saskatchewan, including one *Lasmigona compressa*, confirming the records of Whiteaves and Latchford.

The exact locality for the specimens is as follows: "Township 48, Range 11, west of 2nd meridian, Carrot River, north east of Arborfield, Saskatchewan, (lat. 53° 15′ and longitude 103° 30′). Besides *Lasmigona compressa* the collection comprises numerous specimens of *Lasmigona complanata katherinae* and *Lampsilis siliquoidea* var.

The measurements of the single specimen of *L. compressa* are as follows: Length 88 mm., Height 49.5 mm., Diameter 25 mm., almost twice those given by Simpson for the variety

plebeia and slightly more than those for his smallest typical *compressa*.

On the strength of these records, the range of *Lasmigona compressa* (Lea) should therefore be extended to include the Hudson Bay drainage, at least in the Attawapiskat and Missinaibi Rivers (Ontario) and the Carrot River (Saskatchewan).

1. SIMPSON, CHARLES TORREY: "A Descriptive Catalogue of the Naiades or Pearly Freshwater Mussels," pp. 482 and 483. Detroit, 1914.
2. WHITEAVES, JOHN FREDERICK: "Notes on Recent Canadian Unionidae" *Can. Rec. Sci.* pp. 250-263, January, 1895.
3. LATCHFORD, FRANK R.: "Conchological Notes" *Ottawa Naturalist* 29:51, 1915.

NOTES AND OBSERVATIONS

CHRISTMAS BIRD CENSUS, 1935.—The following additional census report, although mailed on January 2nd, was not sent directly to *The Canadian Field-Naturalist*, was accidentally delayed en route, and was not received by *The Naturalist* until January 31st, too late for inclusion in the main Christmas Bird Census report, which was published in our February issue.—EDITOR.

SUMMERLAND, OKANAGAN LAKE, BRITISH COLUMBIA, December 22, 1935.—From 8:30 a.m. to 4 p.m. Brisk south wind on lake, dying down as day wore on. Cloudy. Average temperature, 24°. No snow. Area: Penticton suburbs, Penticton marsh and two miles of lake shore (by Darcus). Summerland: Five miles of lake front and adjoining fruit benches, back to pine-clad hills. Observers separate.

Horned Grebe, 1; Mallard Duck, 2; American Golden-eye, 1; Buffle-head, 6; Merganser (sp?), 1; Bald Eagle, 1; Ruffed Grouse, 2; California Quail, 275; Common Pheasant, 59; American Coot, 945; Wilson's Snipe, 5; Herring Gull, 20; Belted Kingfisher, 2; Red-shafted Flicker, 51; Hairy Woodpecker, 1; Batchelder's Woodpecker, 1; Black-headed Jay, 3; Magpie, 66; Clarke's Nutcracker, 8; Long-tailed Chickadee, 30; Gambel's Chickadee, 29; Slender-billed Nuthatch, 4; Red-breasted Nuthatch, 6; Pygmy Nuthatch, 28; American Dipper, 4; American Robin, 1; Golden-crowned Kinglet, 6; Bohemian Waxwing, 170; Northern Shrike, 1; House Sparrow, 270; Red-winged Blackbird, 80; Evening Grosbeak, 45; Cassin's Purple Finch, 4; Redpoll (sp.?), 195; American Goldfinch, 80; Shufeldt's Junco, 900; Rusty Song Sparrow, 82. Total, 37 species, 3385 individuals.—S. J. Darcus, S. A. Liddell, H. M. Simpson, E. M. Tait.

EUROPEAN SWALLOW TAKEN ON BOARD SHIP IN MID-ATLANTIC.—J. A. Stevenson's account in the October *Canadian Field-Naturalist* of birds crossing the Atlantic on ships brought to mind a European Swallow, (*Hirundo rustica*), now in the writer's collection, which was taken on board a liner at about mid-Atlantic on May 27th, 1934. The bird was obtained by Mr. R. E. Bennett, of Toronto, who was returning from France, and he reports that soon after sailing from Le Havre on May 24th they ran into a heavy fog during which three swallows appeared and perched in the rigging. The fog continued until dark and Plymouth was reached about midnight where a stop, of only one hour, was made. At daybreak of May 25th the ship was beyond sight of land off Land's End and the three swallows were still aboard. They continued to fly about or perch aloft for two days but on May 27th in the afternoon all three came down in a very weak condition and attempted to hide by crawling into out-of-the-way places on deck. Two of them did disappear but one was secured by Bennett who took it to his cabin where it died that evening. This specimen is a male in good plumage but was found, when skinned, to be in an extremely emaciated condition, probably having been without food or water for at least three days. It is easy to understand that a swallow would be at a peculiar disadvantage on ship board, as compared, for instance, with any of the finches, but it seems surprising that with their powers of flight they would not attempt to reach land.—R. J. RUTTER.

UNUSUAL BEHAVIOUR OF A SPARROW HAWK.—While I was walking over the open range at Okanagan Landing, British Columbia, recently, I noticed a female Sparrow Hawk drop into the dry grass fifty yards ahead of me and in a few moments rise again with a large vole, probably *Microtis nanus cannescens*, in her claws. The little falcon, carrying the animal head foremost and in a horizontal position, flew to a fence post about 100 yards from where I stood watching through 6X binoculars. Almost immediately she dropped the vole which fell on to a fence wire below and hung balanced there. The bird

craned forward, apparently looked at the vole for a moment, and then flew off. On walking over to the post I was surprised to find nothing but a few drops of blood on the ground below. The vole had fallen from the wire and recovered sufficiently to disappear into the adjacent grass.—J. A. MUNRO.

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*Chenopodium polyspermum** AT OTTAWA. — For the first time, so far as records show, this sparingly introduced European weed was found here, when, on August 10, 1935, an area near the Rockcliffe ski-slide was being searched, in company with W. G. Dore, for another plant. The plant is reported from Quebec province in Marie-Victorin's *Flore Laurentienne*. In appearance it might pass for the common Lamb's-quarters, *C. album*, grown spindly from shading, but it lacks the mealiness of that species. The flowers are in slender panicles, not so glomerate as in Lamb's-quarters; and the seeds are smaller and not so nearly enclosed by the calyx lobes.

Although a potential weed, this species has not yet made a place for itself in the weed literature of America. Specimens seen have shown a propensity for flowering from top to bottom, and even on dwarfed plants of a few inches in height.—H. GROH.

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* *Contribution No. 441 from the Division of Botany, Experimental Farms Branch, Department of Agriculture, Ottawa, Canada.*

THE HUDSONIAN CURLEW (*Phaeopus hudsonicus*) IN CENTRAL ALBERTA.—While watching a pair of Marbled Godwits (*Limosa fedoa*) feeding in a meadow at the south-western end of Bittern Lake, on May 26th, 1935, a scattered flock of about twenty, large, brown waders, which I believed to be Godwits, swung in from the south and alighted close to the pair I had under observation. Walking towards them, two Godwits took wing and came to meet me, scolding loudly at my intrusion. Almost immediately, the flock rose and continued their flight northwards. As they passed out over the lake, I recognized the "curlew whistle" given by several of the birds, and on looking at them with my glasses I easily discerned the decurved bills.

The following day I again visited the locality hoping to see the birds once more, and, if possible, secure a specimen, but without success. On May 31st, while walking along the north shore of Baker Lake, less than a mile west of Bittern Lake, I found two Curlews feeding in company with a pair of Marbled Godwits. One of the Curlews was collected, and this proved to be a female Hudsonian. The skin was presented to the National Museum, Ottawa.

Although these Curlews probably pass through this region every year to and from their nesting grounds within the Arctic circle, this is the first time I have recorded them in this territory. —FRANK L. FARLEY, *Camrose, Alberta.*

UPLAND PLOVER IN VICINITY OF OTTAWA. — For three seasons since 1933 this interesting bird has frequented the J. R. Booth pastures near Shirley Bay, and in 1933 was also once seen outside the rifle ranges, South March. No careful search for a nest has been conducted. The birds themselves have been an attraction for nature classes in the Y.M.C.A. Boys' Camp on the Booth property. The nearest record heretofore seems to be that from Crysler, Ont., thirty miles southeast of Ottawa, which appeared in *The Birds of Ottawa - Addenda*, by Hoyes Lloyd, *Can. Field-Nat.* 45: 125, 1932.—H. GROH.

RED SQUIRREL FEEDING ON MEADOW MOUSE.—On December 8, 1935, on the grounds of the Glen Mawr golf club near Toronto I noticed a Red Squirrel (*Sciurus hudsonicus loquax* Bangs) feeding on something near the top of an apple tree. Closer attention revealed that the meal was being made from the carcass of a Meadow Mouse (*Microtus*). The mouse was hanging by the foreparts in such a position as to suggest that it had been placed there by a shrike, and the squirrel was gnawing at the head with very evident enjoyment. There were several frozen apples nearby but the mouse seemed to be preferred to these. Red Squirrels and Meadow Mice are both rather abundant at the present time in the locality referred to in this note.—R. J. RUTTER.

BOOK REVIEWS

Discoid cephalopod fossils coiled in serpentine fashion have caught the fancy of poet and peasant alike for centuries. When geology was only a budding science Sir Walter Scott referred to the ammonites in his "Marmian":

"Thus Whitby's nuns, exulting, told
How that, of thousands of snakes each one
Was changed into a coil of stone,
When holy Hilda prayed".

The Yorkshire snake stones of England,—the products of pious Hilda's prayers,—according to Scott's poetic fancy, are the ammonites of Richardson's famous poem. In it the ammonite and the nautilus are pictured as sailing the geologic seas together for many long aeons till the ammonite became extinct, leaving to survive it the lonely nautilus of our modern seas which:

"Still seems to seek in bay and creek,
Its companion of other days."

Both, we are told, set out together:

"The nautilus and the ammonite
Were launched in storm and strife:
Each sent to float in its tiny boat,
On the wide, wild sea of life".

There will be launched this month a new type of publication which will present in biological order complete descriptions with figures of all the Devonian Ammonoids or "Snake Stones" which have been described from North American rocks. It will be the first publication unit issued of the:

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Each species occupies one side of a single card 8" x 11" with figures of type fossils and text adjacent, the acme of convenience and the last word in efficiency. Under the heading *Observations,* the cards give much new and significant information. The known geological and geographical distribution of each species is given. Each card bears its own number and date of publication. Reproduction will be by photogelatine process. Since the cards are not bound, new species as they appear can be placed in their proper position in the unit thus enabling the user to keep it perpetually up to date.

This method of bringing together on a biologic and stratigraphic basis all of the material needed for identifying North American Devonian ammonoids should be a great stimulus, to amateur and professional palaeontologists alike, to extend our knowledge of the early ammonoid fossils. Improvement in the methods of extending knowledge of fossils and of using such knowledge has been the sole object in undertaking the preparation of the Devonian Ammonoidea. Advance subscriptions should be sent to the Wagner Free Institute of Science, Philadelphia, Pa., which is making possible the publication of this work. The author and compiler of this unit of the Devonian cards is Prof. A. K. Miller. His published papers are a sufficient guarantee of the quality of the work which has gone into the Devonian Ammonoidea which has been prepared under the general direction of a committee of the Palaeontological Society of America. Sample cards can be had from the publisher.—E. M. KINDLE, *Geological Survey of Canada.*

Transactions of the Bose Research Institute, Calcutta. Vol. 9, 1933-34. *Longmans, Green & Co., Toronto.* $5.50. *pp.* 210. *illus.* 62.

There are few workers in science to whom the name and the work of that distinguished Hindu scientist, Sir J. C. Bose, are not familiar. His researches in the physiology of plants are of absorbing interest and this, the ninth volume of the Transactions of the research institute of which he is director, continues the description of the ingenious experiments and apparatus which he and his colleagues have developed. For example, it is now possible to determine the actual moment of the initiation of embryonic growth in a seed before the rupture of the external seed-coat and the appearance of the radicle. Another ingenious mechanism records simultaneously the lateral and longitudinal growth of a plant, and another the velocity of transmission of stimulus in the sensitive Mimosa. Research work of this type is not only of value to the plant physiologist, but of great interest to the layman.—D. L.

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The official publications of THE OTTAWA FIELD-NATURALISTS' CLUB have been issued since 1879. The first were *The Transactions of the Ottawa Field-Naturalists' Club*, 1879-1886, two volumes; the next, *The Ottawa Naturalist*, 1886-1919, thirty-two volumes; and these have been continued by *The Canadian Field-Naturalist* to date. *The Canadian Field-Naturalist* is issued monthly, except for the months of June, July and August. Its scope is the publication of the results of original research in all departments of Natural History.

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VOL. L OTTAWA, CANADA, APRIL, 1936 No. 4

SOME NOTES ON THE MONKFISH OR ANGLER (Lophius piscatorius Linn.)

By R. A. McKENZIE

Atlantic Biological Station, St. Andrews, N.B.

ON JUNE 19, 1933, a fisherman, Lionel Pelham of Herring Cove, Nova Scotia, submitted a mass of monkfish spawn to Dr. A. H. Leim, Director of the Fisheries Experimental Station, Halifax, Nova Scotia, for identification. After being out of water for six to eight hours, this spawn was placed by the author in a jar supplied with running salt water for further development.

The spawn had been picked up at the surface about the centre of Halifax harbour, where, for the week previous, the surface temperatures had ranged from 8°—10°C., and the bottom temperatures in twenty-five to thirty metres had ranged from 2.5°—6.5°C. (Temperature records by the M. V. *Zoarces*).

These fish, known locally along the shore as monkfish, are reported by the fishermen to be commonly taken in their fishing operations from May and June until December. They are said to be very common in the autumn. Definite records show them to be found, in July and August at least, in a fairly wide range of depths, for, on July 31, 1933, a female with eggs in the earliest stage of development was captured off the Dartmouth, Nova Scotia, ferry wharf by means of a boat-hook, while on August 3, the *Zoarces* captured five in a drag trawl on a gravel bottom in a hundred and forty metres of water when the bottom temperature was about 5°C. These fish also possessed gonads in the earliest development stages.

This, together with the fact that the eggs taken on June 19, were in a very early stage of development, seems to indicate that in this region these fish spawn about the middle of June which corresponds to the spawning time south of Cape Cod reported by Bigelow, (1925), as well as that reported for the Plymouth, England, region by Lebour, (1925).

Since these eggs were taken at such an early stage of development well up in Halifax harbour, it seems reasonable to conclude that some of these fish at least spawn in the shoal waters of the harbour, which is in agreement with other descriptions of the spawning along the Atlantic coast of Canada and the United States but in opposition to the ideas on the spawning of the European form of this fish, for in the northern European waters it is supposed to spawn out to sea.

The eggs brought in on June 19, were still firmly embedded in the gelatinous ribbon, only a piece of which had been brought in for identification. The diameter of these eggs ranged from 1.6 to 1.8 mm., and when first obtained had developed only to a multicellular stage in which the body was not differentiated.

On June 24.—temperature varying meanwhile from 12°—14°C. in the hatching jar—the eggs had developed to the stage where the embryonic disc had grown completely round the yolk and the young embryo possessed definitely formed eyes.

Hatching occurred on June 25 and 26, by which time the temperature had gradually risen to between 15.0° and 15.5°C. At hatching, the young larvae varied from 2.5 - 3.1 mm. in length and appeared much as depicted by Lebour, 1925, and Berrill, 1929.

By June 28, their length had increased to about 3.7 mm., and by June 30, they were approximately 4.6 - 4.9 mm. long. On this latter date the yolk sac was appreciably smaller and the tiny pectoral and ventral finfolds were visible, as well as the small projection or lobe at the anterior dorsal margin of the embryonic finfold, which according to Agassiz, 1882, later becomes the second head spine of the adult.

The specimens taken from the hatching jar on July 3, varied from about 5.0 to 5.7 mm. in length. From June 26 to this date, the water temperature had ranged from 15.5° - 17.0°C. Up to this time, the young larvae, when quiescent,

floated yolk sac uppermost just under the surface film, swimming down frequently, only to rise to the surface again when they ceased swimming.

These young larvae of July 3, averaged only 5.2 mm. in length, but possessed definitely developed pectoral and ventral fins. The former averaged 0.7 mm. in length, while the latter, as yet only a single long process, averaged 1.6 mm. in length. The rudimentary first dorsal ray mentioned previously now varied from 0.4 - 0.6 mm. in length. In the larger specimens, where this ray was about 0.5 - 0.6 mm. in length, a second dorsal ray immediately posterior to the other was visible as a tiny conical projection.

Such fin development, when the total length of the larvae was only about 5.2 mm., is greatly in advance of that shown by Lebour, 1925. This striking development, especially of the ventral fins, is in agreement however, with the other accounts of the development of the American form of *Lophius*, as contrasted with the European.

At this point the hatching jar overflowed and the remaining larvae were lost.

MAMMALS OF THE WANAPITEI PROVINCIAL FOREST, SUDBURY DISTRICT, ONTARIO

By D. A. MacLULICH, B.Sc.F.

DURING the period from May to September of 1929 the writer was employed by the Ontario Forestry Branch with a party in the Wanapitei Provincial Forest. The work, under the direction of J. A. Brodie, consisted of an intensive forest survey as a basis for future plans for management and research. Incident to this work casual records of mammals were made by the writer both from personal observation and from reliable reports. As might be expected, sufficient collecting of specimens to demonstrate the racial forms of the region was impossible and consequently specific identity is all that is attempted below. In fact several species of mice and shrews which would be expected in this region were not recorded. The few specimens collected are in the Royal Ontario Museum of Zoology. The three measurements, total length (T.L.), tail vertebrae (T.V.) and hind foot (H.F.) are given in millimeters. The area comprises the townships of Norman, Parkin, Aylmer and that part of Rathbun which borders the north shore of Lake Wanapitei, in the district of Sudbury.

Work in adjacent regions may be mentioned for convenient reference. J. Dewey Soper (1920, 1921) wrote on the mammals of Ridout in the District of Sudbury but that place is some 120 miles northwestward of this locality. Soper (1923) published "a biological reconnaisance of portions of Nipissing and Temiskaming districts, Northern Ontario". Professor A. F. Coventry (1931, 1932) has reported on the occurrence, and changes in abundance, of mammals in the region around Lake Timagami which is only about thirty miles to the east and a few miles northward. The only species found in the Wanapitei area but not yet reported from Timagami are the Brewer's mole and the raccoon.

Parascalops breweri, BREWER'S OR HAIRY-TAILED MOLE. Mr. Casselman, a local resident, has seen this species and described the animal in detail. He knew it was not a star-nosed mole or short-tailed shrew, with both of which he was familiar. This record is used because it has been substantiated by specimens from parts of the province both east and west of this region.

Condylura cristata, STAR-NOSED MOLE. A decayed specimen was found in an open jack pine forest in Parkin Township near Mountain Creek.

Sorex cinereus, CINEREOUS SHREW. Quite common; one was taken in a freshly dug pit in poplar bush.

♀, T.L.94, T.V.45, H.F.12, Aug. 3.

♀, T.L.97, T.V.44, H.F.11.5, Sept. 1.

Microsorex hoyi, PYGMY SHREW. One was collected in the pit mentioned above in poplar bush with much *Aster macrophyllus* on the ground, in Aylmer Township.

♀, T.L.91, T.V.34, H.F.10, July 25.

Blarina brevicauda, SHORT-TAILED SHREW. One was seen in Parkin Township but none collected and the species must have been scarce that year.

Myotis sp., LITTLE BROWN BAT. Rather frequently seen.

Ursus americanus, BLACK BEAR. Very common, especially in burned areas in the northeast part of Aylmer Township. Pairs of cubs with their mothers were seen several times. A bear

killed a large pig at a lumber camp on the Wanapitei River and carried it a quarter of a mile away.

Procyon lotor, RACCOON. One individual was observed on the shore of a lake-like part of Mountain Creek near Bear Lake. The nearby bush was mixed poplar and white pine. The raccoon appeared to wash something in the water. This was in bright sunlight in the afternoon.

Martes pennanti, FISHER. Mr. Alcock, a local resident, reported "a few about".

Mustela cicognanii, BONAPARTE WEASEL. Active about camps, catching mice. Mr. Casselman's cat killed one which was preserved.

♂, T.L.281, T.V.78, H.F.35, Aug. 18.

Mustela vison, MINK. Several seen, but not very common

Mephitis mephitis, SKUNK. A few around.

Vulpes fulva, FOX. None observed or heard but said to be common.

Canis sp., WOLF. We heard them howling twice and their tracks were on an old road that was frequented by deer and moose.

Lynx canadensis, CANADA LYNX. According to Mr. Alcock lynx are not scarce.

Marmota monax, GROUNDHOG. Common in Norman Township in the brulés on gravel and sand plains and on scrubby hillsides, but few in the more forested Parkin Township or the more barren Aylmer Township.

Eutamias minimus, WESTERN CHIPMUNK. Uncommon, about one-fifth as abundant as the other chipmunk (*Tamias*).

Tamias striatus, EASTERN CHIPMUNK. Common.

♀, T.L.228, T.V.92, H.F.34, July 28.

♀, T.L.215, T.V.85, H.F.35, July 23.

Sciurus hudsonicus, RED SQUIRREL. Fairly common and found in both brulé and timber. On July 14 a red squirrel was seen to carry up a tree a neat sheaf, 1½ inches long, of green grass, holding it firmly in its mouth by the centre. This might have been for nesting purposes.

Glaucomys sabrinus, NORTHERN FLYING SQUIRREL. Mr. Alcock said they were fairly numerous, often being caught by his cat and in traps in winter.

Castor canadensis, BEAVER. There are a few in rather inaccessible places, especially in Parkin Township. Evidences of their presence, such as one or more of the following: fresh cuttings, repaired dams, occupied houses, used trails or canals, were found in at least seven different places.

Peromyscus maniculatus, WHITE-FOOTED MOUSE. Very abundant in most habitats this year.

♂, T.L.169, T.V.84, H.F.21. July 28.

♂, T.L.167, T.V.86, H.F.21, July 28.

♂, T.L.173, T.V.86, H.F.20, July 14.

Clethrionomys gapperi, RED-BACKED MOUSE. One was seen in a cabin in white pine woods in Norman Township.

Microtus pennsylvanicus, MEADOW MOUSE. Fairly common, chiefly in damp, grassy situations.

♂, T.L.130, T.V.36, H.F.20, July 29.

Ondatra zibethica, MUSKRAT. Several observed; said to be common.

Zapus hudsonius, MEADOW JUMPING MOUSE. Observed at a number of scattered places; very abundant around the camp at the head of West Bay of Lake Wanapitei in grassy white birch second growth.

♀, T.L.199, T.V.126, H.F.31, Aug. 26.

Napaeozapus insignis, WOODLAND JUMPING MOUSE. One collected in young white birch woods.

♀, T.L.229, T.V.144, H.F.31, Sept. 8.

Erethizon dorsatum, PORCUPINE. Only five observed.

Lepus americanus, VARYING HARE or SNOWSHOE RABBIT. Five seen; the hare is quite rare in the region this year. J. Dewey Soper (1921, p. 104) said that 1916 was a rabbit year about Sudbury.

Odocoileus virginianus, WHITE-TAILED DEER. Tracks were common and several were seen, so it was moderately common. The noise made by a survey party frightens deer away from before them. Fawns were observed twice.

Alces americana, MOOSE.. One, a cow, was seen but tracks were fairly numerous. Moose and other game appear to be unusually wary in this district. This is probably due to frequent hunting as the city of Sudbury is only twenty miles distant.

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LAND AND FRESHWATER MOLLUSKS COLLECTED ON A TRIP TO JAMES BAY

By HORACE G. RICHARDS

New Jersey State Museum, Trenton, N.J.

IN AUGUST, 1933, the writer took a trip through northern Ontario and Quebec to James Bay. The main purpose of the trip was to collect marine mollusks (Recent and Pleistocene) from James Bay; a report on these is published elsewhere. (1)

Moosonee is on the west bank of the Moose River about five miles from Moose Factory Island, upon which is located the well known trading post of the Hudson's Bay Company, and about nine miles from James Bay. Since various lists had been published of the mollusks of Moose Factory, more of our time was spent collecting from the various other islands in the region. The water at Moose Factory was fresh during the time of our visit, although after heavy winds from the north, salt water from James Bay is said to be carried down as far as Moose Factory.

A canoe trip was taken down the Moose River to Shipsands Island at the mouth of the river. Even here the water was fresh, although the presence of unworn shells of *Macoma balthica* (Linn.), *Mytilus edulis* Linn. and *Paludestrina minuta* (Totten) suggested that the water was at times somewhat brackish. Land and freshwater shells were abundant in the beach drift.

Along the banks of the Moose River near Moose Factory there is a deposit of fossil-bearing clay. The fauna is marine and is thought to be of post-Glacial age (Pleistocene), deposited at a time when the land was lower. On top of this clay there is frequently a layer of silt containing freshwater or land shells. All this material is much younger than the marine deposits and much of it may be very recent. For convenience they are termed "sub fossils". The following species were noted: *Discus cronkhitei anthonyi* (Pilsbry), *Zonitoides arboreus* (Say), *Z. nitidus* (Müller), *Retinella hammonis* (Ström), *Cochlicopa lubrica* (Müller), *Succinea ovalis* Say, *S. retusa* Lea, *S. avara* Say, *Lymnaea artica* Lea, *Valvata tricarinata* (Say), *Sphaerium solidulum distortum* (Prime), *Musculium transversum* (Say).

After several days in the vicinity of Moose Factory I was fortunate in being able to visit Charlton and Cary Islands in James Bay, about eighty-five miles north of Moose Factory. Two lakes were visited on Charlton Island; in one, known as Freshwater Lake, in the interior of the island, about four miles from the sea, the water was very acid, and consequently the shells (*Physa heterostropha* (Say), *Lymnaea stagnalis jugularis* Say) were very fragile. The other lake, "Saltwater Lake" is really an arm of the bay. At the time of my visit the water was fresh and supported a freshwater fauna (*Gyraulus arcticus* (Beck), *Physa gyrina* (Say), *Lymnaea* cf. *catascopium* Say, *L. palustris* cf. var. *elodes* (Say) and *Pisidium mainense* Sterki). Unworn shells of *Paludestrina minuta* (Totten), *Macoma balthica* (Linn.) and *Littorina rudis* (Maton) give evidence that a change in the direction of the wind might cause the waters of "Saltwater Lake" to become brackish.

L. palustris ungava Baker, was abundant in the brackish pools above the tidal zone on Cary Island.

ACKNOWLEDGEMENTS

In addition to material collected on the above trip, there are listed a few mollusks collected on visits to Rivière du Loup, Quebec, in October, 1933, and to Algonquin Park, Ontario, in August, 1934. I was also fortunate in receiving material collected by various friends in this region. William Ransohoff sent an interesting collection from St. Joseph's Island, Ontario; Ludger Cataford supplied me with a number of mollusks from the vicinity of North Bay; Reginald and Maude

1 *American Midland Naturalist*. 17: 528-545 (1936)

Louttit sent me additional material from Moose Factory and Charlton Island; Anatole Pichette some shells from Temiscamingue County, Quebec, and Mr. Frank R. Pentlarge and party sent me a few freshwater snails taken from the Rupert River on a trip from Lake Mistassini to James Bay, a route very infrequently travelled.

I am indebted to Mr. E. G. Vanatta, of the Academy of Natural Sciences of Philadelphia, for considerable help in the preparation of this paper. I am also indebted to Dr. H. A. Pilsbry and Dr. F. C. Baker for their opinions on certain critical species.

The collection has been divided between the Academy of Natural Sciences of Philadelphia, the National Museum of Canada in Ottawa and the Carnegie Museum in Pittsburgh, Pennsylvania.

LIST OF SPECIES COLLECTED

Polygyra albolabris (Say)
Scarborough, Ont.

Discus cronkhitei anthonyi (Pilsbry)
Moose River, Moose Factory and Butler Island (recent and sub-fossil); Outlook, Algonquin Park, Ont.

Euconulus fulvus (Müller)
Shipsands Island and Butler Island in Moose River, Ont.

Carychium exile canadense Clapp
Shipsands Island.

Zonitoides arboreus (Say)
Moose Factory; sub-fossil along Moose River at Butler Island and 3 miles below Moosonee; Outlook, Algonquin Park, Ont.

Zonitoides nitidus (Müller)
Recent and sub-fossil at Butler Island. Moose River, Ont.

Cochlicopa lubrica (Muller)
Moose Factory; Butler Island, Moose River (recent and sub-fossil).

Succinea ovalis Say
Living and sub-fossil along Moose River on Butler Island, Charles Island and 3 miles below Moosonee.

Succinea retusa Lea
Living at Moosonee and Shipsands Island, Ont.; living and sub-fossil at Charles Island, Butler Island and 3 miles below Moosonee. Dall and Whiteaves found this species near Moose Factory; Goodrich reports *S. haydeni* Lea from Moose Factory (2).

Succinea avara Say
Butler Island, Moose River, Ont. (sub fossil)

Deroceras laeve var. *campestre* (Binney)
(*D. gracile* Raf.)
Among boards near warehouse of H. B. Co., Moose Factory; The slugs questionably referred to *Agriolimax agrestis* (Linn.) by Goodrich from the same locality are probably this species (3).

Bulimnea megasoma (Say)
Swastika, Ont.

Lymnaea stagnalis jugularis Say
Baie de l'Orignal, Que.; Rivière Solitaire, Que.; Freshwater Lake, Charlton Island, N.W. T. (4). These were not variety *lillianae* Baker of western Ontario.

Lymnaea palustris cf. var. *elodes* (Say)
Baie de l'Orignal, Que.; Abitibi River, 12 miles north of Iroquois Falls, Ont.

Lymnaea palustris ungava Baker
Saltwater Lake, Charlton Island, N.W.T.; Cary Island.

Lymnea emarginata canadensis (Sowerby,)
Hilton, St. Joseph's Island, Ont.

Lymnaea arctica Lea.
Moose River, Ont., at Moose Factory, Moosonee, 3 miles below Moosonee (recent and sub-fossil) and Shipsands Islands. Some of the specimens very strongly resemble *L. pinguis* Say, but they are all placed as varieties of *arctica* by Baker.

Lymnaea cf. *catascopium* Say
Saltwater Lake, Charlton Island, N.W.T.; Abitibi River, 12 miles north of Iroquois Falls, Ont.

Lymnaea catascopium niagarensis Baker
Niagara River, Fort Erie, Ont.

Lymnaea columella Say
Stream near Scotia Junction, Ont. (5).

Helisoma campanulatum minus (Dkr.)
Baie de l'Orignal, Que.; Lake Couchiching, Orillia, Ont.

Helisoma anceps (Menke)
Trout Lake, near North Bay, Ont.; Doe Lake, Emsdale, Ont.; St. Joseph's Island, Ont.; Moose River, Ont., and Butler and Shipsands Islands.

---

2 See Goodrich, Calvin, Mollusks of Moose Factory, *Nautilus*, 47: 7-9.

3 Other land mollusks collected by Goodrich at Moose Factory are: *Pupilla muscorum* (Linn.), *Vertigo pygmaea* (Drap.) and *V. ventricosa* (Morse).

4 All islands in James Bay are part of the Northwest Territories.

5 To the above species of *Lymnaea* there should perhaps be added *L. rustica* Lea and *L. perplexa* Baker & Henderson found by Goodrich at Moose Factory.

Helisoma anceps royalense (Walker)
Baie de l'Orignal, Que.; Rupert River, 46 miles east of Lake Mistassini, Que.

Gyraulus hornensis Baker
Shipsands Island, Moose River, Ont.; "Saltwater Lake", Charlton Island, N.W.T.

Gyraulus parvus (Say)
St. Joseph's Island, Ont.; Canisbay Lake (Cranberry), Algonquin Park, Ont.

Gyraulus hirsutus (Gould)
Moose Factory, Ont.

Physa heterostropha (Say)
Sundridge, Ont.; Abitibi River, 12 miles north of Iroquois Falls, Ont., Moose River at Moosonee and Moose Factory, Ont.

Physa gyrina (Say)
Swastika, Ont.; Russel Creek, Matheson, Ont.; Rivière Solitaire, Que.; Doe Lake, Emsdale, Ont.; Lake Nipissing, Callander, Ont.; Freshwater and Saltwater Lakes on Charlton Island, N.W.T.

Physa integra Hald.
Russel Creek, Matheson, Ont.

Physa integra niagarensis Lea.
Niagara River, Fort Erie, Ont.

Physa ancillaria Say
Trout Lake, near North Bay, Ont.; St. Joseph's Island, Ont.

Valvata tricarinata (Say)
Moose River at Moose Factory, Butler and Charles Islands (recent and sub-fossil) and Shipsands Island; St. Joseph's Island, Ont.

Valvata tricarinata perconfusa Walker
Moose River, Moose Factory and Shipsands Island.

Valvata tricarinata infracarinata Vanatta
Shipsands Island, Moose River, Ont.

Valvata sincera Say
Shipsands Island.

Cincinnatia cincinnatiensis (Anth.)
St. Joseph's Island, Ont.

Cincinnatia binneyana (Han.)
Shipsands Island.

Amnicola limosa (Say)
Baie de l'Orignal, Que.; Doe Lake, Emsdale, Ont.; Canisbay Lake (Cranberry), Algonquin Park, Ont.; Moose River at Moose Factory and Shipsands Island.

Goniobasis livescens Menke
Niagara River, Fort Erie, Ont.

Campeloma decisum (Say)
Niagara River, Fort Erie, Ont.; Mary's Lake, Port Sydney, Ont.; Doe Lake, Emsdale, Ont.; mouth of Dushesne Creek, Lake Nipissing, Ont.; Trout Lake, near North Bay; St. Joseph's Island, Ont.

Paludestrina minuta (Totten)
Unworn shells of this species were found on Shipsands Island at the mouth of Moose River and at Saltwater Lake on Charlton Island; the water at both places was fresh, but at times becomes brackish. This species is very characteristic of brackish water.

Bythinia tentaculata (Linn.)
St. Joseph's Island, Ont.

Elliptio complanatus (Sol.)
Mary's Lake, Port Sydney, Ont.; Doe Lake, Emsdale; South branch Magnetewan River, Burks Falls; Lake Nipissing, Callander; Mouth Duhesne Creek, Lake Nipissing; Trout Lake, near North Bay, Ont.; Baie de l'Orignal, Que.; St. Louis de Nédélec, Que.; Rivière du Loup, Que.

Lampsilis siliquoidea Barnes
Niagara River, Fort Erie, Ont.; Baie de l'Orignal, Que.; Rivière du Loup, Que.; Moose River at Moose Factory, Moosonee and Charles Island, Ont.; Charlton Island, N.W.T. Occasionally eaten by the Indians.

Lampsilis radiata (Gmel.)
St. Joseph's Island, Ont.; Lake Nipissing, Ont.; St. Louis de Nédélec, Que.

Anodonta grandis footiana Lea
Doe Lake, Emsdale, Ont.; South branch Magnetewan River; Burks Falls, Ont.; Baie de l'Orignal, Que.

Sphaerium solidulum (Prime)
St. Joseph's Island.

Sphaerium solidulum distortum (Prime)
Baie de l'Orignal, Que.; Moose River at Moose Factory, Charles Island (living and sub-fossil) and 3 miles below Moosonee (sub-fossil).

Sphaerium occidentale (Prime)
Freshwater Lake, Charlton Island, N.W.T.

Musculium transversum (Say)
Moose River, Charles Island, Ont. (sub-fossil).

Pisidium mainense Sterki
Saltwater Lake, Charlton Island, N.W.T.

THE BEAVER OF THE RIDING MOUNTAIN, MANITOBA

AN ECOLOGICAL STUDY AND COMMENTARY

By H. U. GREEN

(*Continued from page* 50)

DAMS

The dams of all beaver ponds in the Riding Mountain are identical in general character, and although I have not had the good fortune actually to witness one under construction the manner of their building affords sufficient evidence of how they are raised and what material is utilized for the purpose. The following data were gleaned from the ponds under observation, and while excavating several old beaver sites in the Vermilion River valley.

From the evidence it appears that branches of aspen-poplar and willow and what loose woody material is available are conveyed to the site of the dam and laid with the butts, or thick ends, pointing upstream. Mud, fibrous debris, and sometimes gravel and stones, obtained from the near vicinity, are carried and deposited thereon to weight the material down and bind it together. Alternate layers raise the structure to the desired height. The dams constructed by the beavers of the Riding Mountain may be called "brush" dams, because no heavy material is used to build them. In fact anything over a diameter of 2½" is an exception worthy of special note. This, of course, does not apply to drift wood brought down by the stream.

It cannot be said at what point the work begins, but it would seem that the channel of the stream first receives attention. The structure is then extended across the valley floor to the base of the slope on one or both sides, depending upon the course taken by the stream.

When the brush work is completed and the crest well plastered with mud, there is reason to believe that the dam leaks in many places and to prevent the loss of water the inside face is ramped with mud. Many of the old dams examined not only have a sloping inner face but near the wings deep trenches follow the contour. It would seem that the trenches were dug for the purpose of securing mud to build the ramp.

Silt, too, carried downstream by freshets, increases the bulk of the ramp, especially in the line of flow, and not only re-enforces the dam but assists materially to keep it watertight. Nevertheless a certain amount of leakage occurs from time to time about the crest when the pond is brim full and overflowing. The extreme ends, or wings, of the dam, where usually only a low mud wall exists, are always troublesome, for water constantly breaks the barrier and trickles away until the leak is noticed and the break repaired.

When a dam is well constructed and becomes reasonably watertight there is no necessity for adding other than repair material for several seasons. With the passing of time, however, the ponds silt up and the depth of the water is lowered proportionally. As previously explained depth is essential for the welfare of the beaver inhabitants, and if no measures were taken to offset the accumulation of silt the pond would ultimately become unsuitable to occupy with safety. To overcome this the dam is raised and the depth of water increased. There is, of course, a limit to the height of a dam, which explains the abandonment of several old sites that have reverted to small areas of meadow land.

With the passing of time willows, grass, and other rank vegetation take root on the crest and outer face, binding the material more strongly together. As the dam becomes old the woody substance decomposes and the structure becomes a mass of closely packed mould. In many instances it appears like a natural barrier.

The fact that the surplus water of all ponds examined, including in particular Sites Nos. 1, 2, and 3, invariably finds an outlet by way of a spillway situated where the dam crosses the channel of the stream is interesting because every dam appears to have been purposely constructed so as to form a depression thereabouts as if to direct the swiftest flow of water to where it can be most conveniently carried away. When one considers that sudden freshets naturally follow the lowest part of the valleys which, unless badly silted, are the stream beds or channels, consequently a spillway in the main line of flow prevents the possibility of the crest of the dam being washed away. This, I believe, is another instance of engineering foresight highly creditable in so small a mammal. Of course there may be some other explanation.

No dams have been encountered that are actually straight, although they follow a line of definite direction. The majority are semi-

Dam at Site No. 1. The stream in the background comes from the spillway. The stream to the right originates from a leak beside the bank.

Photograph by H. U. Green.

circular, semi-elliptical, or serpentine. The reason for deviation from straight line construction is, I think, that after selecting a dam site the beavers are influenced by the contour of the ground and take advantage of the highest elevations and avoid as much as possible any hollows or low ground that would require additional labour to fill. This contention appears to be borne out by evidence after a careful survey of almost any beaver site, old or new. Consequently all the Riding Mountain beaver dams are of greater length than a direct line from bank to bank. This, I feel quite sure, is yet another example of beaver intelligence, for to reason how an engineering project can be accomplished with a minimum of time and labor, is to think of three things at once.

The longest dam recorded measured 276 feet in length; the shortest 25.5 feet. Both were approximately 4 feet wide at the base, and 4 feet and 4.5 feet in height.

The dams at the ponds under observation measured as follows:

Site	Length	Extreme width at base (approx.)	Extreme height
No. 1	119'	4.5'	4.6'
No. 2			
Upper pond	205'	5'	3.8'
Lower pond	108'	6'	4.5'
No. 3	253'	5.5	5.4'

Apart from the main dams of the ponds under observation, and elsewhere, other small dams are built below and some distances away, creating little pools whose purpose I cannot explain. In my early notes they are referred to as "buffer" dams because it was then believed their design was to act as a buffer should the main dam suffer sufficient damage to allow a large volume of water to escape. Later investigation, however, indicated that the crests of the small dams was considerably lower than the crest of the main dams, and should the main dams break the pools created by the small dams would be capable of holding no more water than they would do under normal conditions. Had the crests been of equal height the "buffer" dam idea is tenable, at least in theory. On the other hand, if the water retained by the small dams backed up to the base of the main structures with sufficient depth, weight and volume might offer a certain amount of resistance to strengthen them in an emergency. But this does not occur, even in times of flood. The pools are fed from the overflow of the main ponds by way of the spillway of the dam and the channel of the stream across which the smaller dams are built. I would also point out that no water connection exists between the ponds and the pools other than the shallow stream of the overflow.

Island lodge Site No. 1 in mid-winter. In seasons of heavy snowfall the lodge would be entirely covered.

Photograph by H. U. Green.

The idea of a water route for the conveyance of food to the pond, gathered from the lower reaches of the valleys, was also considered as an explanation for their presence, but the lack of sufficient water between the dams at once questions the possibility of their use for this purpose. In any event there would be no object in the beavers' journeying far afield in search of food or building material when in every instance an ample supply could be harvested about the banks of the main ponds. There is, though, a possible value to the pools. They may afford havens of safety to the beavers when abroad away from the vicinity of the main ponds.

It is of interest to note that the first of the small dams (sometimes a series may be found) which I now term "supplementary" dams, are invariably built in the first narrow place or gorge below the main pond. This might suggest that the location of the main dam was governed by this consideration as well as other necessary qualifications. The thought quite naturally occurs, why is not the narrowest part of the valley where the first "supplementary" dam is constructed selected as the location for the main dam. Less work would be required, although the structure would necessarily have to be higher in order to hold back enough water to create a pond of sufficient depth. The logical answer seems to be that the height of a dam necessary to accomplish its purpose is out of the question as the volume and weight of so much water behind a short high dam would quickly carry it away, while a long dam of medium height would more equally distribute the pressure. I have dwelt at some length upon these several points because they are important factors when appraising the efficiency and technique of beaver work.

The distance between the main dam and the first "supplementary" structure seldom exceeds 200 feet. Sites Nos. 1 and 2 have only one "supplementary" dam; Site No. 3 has a series of seven, extending a distance of approximately half a mile from the pond. Except for the first dam all are short, somewhat flimsily built and easily washed away.

The "supplementary" dams of the ponds under observation measured in length as follows:

Site No. 1 37′

Site No. 2 16′

Site No. 3 15′, 7′, 9′, 5′, 6′, 4′, 3′.

The measurements are approximate.

LODGES AND DENS

Strange as it may seem Man was not the first mammal to construct for himself and his family a roofed shelter above ground level, or to appreciate the value and strength of the arch

as a principle in building construction. In each instance he was forestalled by the beaver, for while ancient members of our race were shivering within the draughty shelter of open caves the genus Castor was cozy in a self-made home.

A beaver lodge is indeed a marvel of animal craftsmanship, fashioned to shed rain and bear heavy falls of snow, solid in structure against the assault of land dwelling enemies, and comfortable within at all seasons of the year.

Lodges built by the beavers of the Riding Mountain range may be divided into two kinds:— the "bank" lodge, built on the bank beside deep water, and the "island" lodge, with water on every side. The material utilized in their construction is the same as employed to raise the dams, with the exception that heavier material is sometimes used.

Lodges vary in size depending upon their age, for as more material is added each season than is actually necessary to replace the loss by erosion, the structure in the course of time may assume almost gigantic proportions in relation to the size of the occupants. Size, therefore, is a rather good indication of age, especially when considered in connection with the appearance and height of the dam.

The largest lodge located in the Riding Mountain during the course of my studies, appeared immense. It was very old and had not been occupied by beavers for many years, although there was ample evidence that several generations of skunks had taken advantage of a ready-made home since the beavers' death or departure. Measured from the bottom of the dry pond in which it stood, the extreme height taped 10′ 9″, but originally it must have been much higher because the mass had settled considerably. The extreme diameter at the base measured approximately 19′. Time, though, has no doubt caused the base to spread making the present measurement excessive. When carefully demolished three entrance and exit tunnels were found, the largest, or main entrance, capable of permitting a lean man to gain admittance. The "room" was still very large, roughly circular in shape, with an extreme diameter of 4′ 7″. The height of the roof from the floor measured 8″. This measurement, however, offers little indication of the original height, which was probably three times as great. I estimated the material in this lodge would weight at least 2½ tons.

Many other old lodges situated in dry ponds were demolished in order to learn the manner of construction, size of "rooms", and number of entrances and exists. None approached the previously described structure in bulk or dimensions.

Every lodge investigated contained only one "room", including the lodges in the ponds under observation. The latter, of course, were not destroyed or damaged in any way in order to obtain data relative to their formation.

The "rooms" of the lodges were found to be of various shapes, some almost round, other roughly square or rectangular. All were more or less symmetrical. The floor of the "rooms" consist of sticks covered with a layer of mud from 2 to 4″ deep, inclined slightly towards the main entrance which, I think, is intentional to allow a beaver emerging from the water to drain off and so keep the "room" as dry as possible. Except when evidence of other animal occupation was visible the floors were still strewn with shredded willow bark, and some contained the debris of the last meal. The largest "room" of the lodges examined was in the old lodge previously described. The smallest would scarcely permit two beavers to move about in comfort. Generally there was ample room for an adult pair and their "kittens".

The distance between the floor of the "rooms" of the occupied lodges and the water level of the pond averaged about 7″. This measurement is of vital importance to the beavers and is in relation to the height of the dam as an increased depth in the pond would tend to flood the lodge. On the other hand, insufficient water would offer a better opportunity for land dwelling enemies to enter, beside endangering a winter food supply stored nearby. Consequently when a pond silts up and the crest of the dam is raised to give greater depth to the pond, the floor of the lodge must also be elevated, the "room" enlarged, and the bulk of the lodge increased.

Two tunnels or plunge holes to each lodge is the general rule. Three were sometimes found, and I have one record of four. In each instance, regardless of number, they entered the pond well below water level. What appears to be the general entrance and exit is always the largest in diameter, proceeds direct to the water, and is almost perpendicular. The remainder, whether one or more, invariably take opposite routes to the outside either from the floor or walls of the "room", sometimes passing beneath the floor to the water. The need for at least one large tunnel is apparent when it is realized that food material, some of which consists of

Lodge at Site No. 2, September 23rd, 1933. Note the loose material placed about the apex and the food pile in the water to the right.

Photograph by H. U. Green.

small branches, is conveyed to the lodge for consumption. The other tunnels, too, are undoubtedly constructed to serve the special purpose of emergency exits when a hurried departure of the inmates becomes necessary with the least possible delay.

A beaver lodge is generally described as a conical mass of woody material plastered with mud and fibrous debris, but I think it may perhaps be said that the structure is a mass of hardened muck reinforced with woody material to give shape and strength. Judging from the old lodges demolished it would appear that the amount of mud and fibrous debris is about proportional to the bulk of sticks and twigs. The presence of so much soft material baked by the sun undoubtedly keeps the interior free from trickling leaks during heavy rains. It is also absorbent, keeping the interior of the lodge cool in hot weather and assures sufficient moisture in the mass at freezeup so that the walls may become almost like concrete when filled with frost.

For the reason that the size of a lodge, if occupied by beavers, increases with age the inside walls of the interior can be trimmed back and the "room" enlarged. This occurred at Site No. 3 in the autumn of 1932 without endangering the occupants from outside influences. The average maximum thickness of the walls of 19 old lodges examined was 21.5 inches.

It would seem that the "island" lodge is the preferred style of habitation for beavers on the Riding Mountain range as only two "bank" lodges were located, one quite old and unoccupied, and the other at Site No. 1.

The construction of a "bank" lodge is similar in every detail to a lodge built in the water, except that as dry ground is used for the greater part of the foundation, less material is required. There are possibilities, too, of increasing the accommodation of a "bank" lodge to include an additional "room" or den beneath the ground, connected with the lodge by a burrow. An addition of this kind occurs at the "bank" lodge at Site No. 1, and, I presume that similar dens may be found wherever "bank" lodges exist. In this instance the burrow extends from the floor of the lodge a distance of 11′ in a direct line to the rear, terminating in an almost circular den 32″ in diameter with an extreme height of 13.5″. The burrow, after it leaves the lodge, is 16″ below the surface, sloping downwards to the mouth of the den, 21″ underground. For added protection the den was excavated by the beavers beneath a dense clump of willows, the roots of which would prevent to a large degree the efforts of four-footed enemies to dig them

out or in other way molest them. The beavers frequented the den as much as the lodge.

Although only one family of beavers, an adult male and female and the "kittens" of the ensuing year, occupy a pond, irrespective of whether there are one or more to a site, it is usual to find two lodges at each location, and from the evidence gleaned at the sites under observation one or both are inhabited during the open seasons. In the winter, only one is occupied. Since its creation, and up to 1930, the single pond at Site No. 1 contained the "bank" lodge alone. In the autumn of that year, however, it became necessary for the beavers to construct an "island" lodge to prevent being frozen in on account of low water. At Site No. 2, where two ponds exist, there is a lodge in each pond. Site No. 3 has two lodges.

The following are the measurements of the lodges at Sites No. 1, 2, and 3. A consideration of the figures gives a rough estimate of the size of the "rooms".

		Height above water level	Diameter at water level	Max thickness of walls
Site No. 1	"Bank" lodge	4′6″	12′2″	23″
	"Island" lodge	5′5″	17′5″	26″
Site No. 2	"Island" lodge *Upper pond*	4′8″	17′3″	20″
	"Island" lodge *Lower pond*	5′10″	16″	19″
Site No. 3	"Island" lodge *No.* 1	5′8″	15′4″	22″
	"Island" lodge *No.* 2	4′9″	13′	21″

The number of entrance and exit tunnels of the lodges at Site Nos. 1, 2, and 3, is as follows:

Site No. 1	"Bank lodge	2.
	"Island" lodge	2.
Site No. 2	"Island" lodge *Upper pond*	2.
	"Island" lodge *Lower pond*	2.
Site No. 3	"Island" lodge *No.* 1	2.
	"Island" lodge *No.* 2	3?

Regarding the manner of building, I was fortunate enough to witness the construction of the "island" lodge at Site No. 1 during the autumn of 1930. The water of the pond was lowered in late July through a breach cut in the dam by a farmer seeking to drain the Kennice Meadow above in order to procure hay. The season was dry, precipitation light, and evaporation above the average. As a result the "bank" lodge became unsafe for winter quarters. Besides it would be impossible to store food without danger of the pile freezing to the bottom. I was fearful of the beavers' future, and watched very carefully to see what they would do to avert disaster.

On September 12th, I noticed that several aspen-poplars had been felled in a nearby stand and stripped of branches. A number of willows were also cut from a clump beside the water a few feet from the "bank" lodge. Where this material was taken to, it was impossible to ascertain, for all trace was lost at the water's edge. On September 19th, a raft of sticks appeared on the surface of the pond beside the deep channel of the river. An examination of the raft showed that it was deep in the water and rested upon a submerged hummock, the top of which was about 3′ below the surface. It consisted of green aspen-poplar branches cut in sections, dry willows, numerous stones up to 4″ in diameter, gravel, and fibrous debris. The raft was solid enough to bear my weight. This was the foundation of the new lodge. On September 26th the base of the lodge was well above water, composed of small sticks, mud, and muck. The centre of the base was loosely filled with material in constrast to the outside which was of solid construction. On October 5th, the exterior of the structure was complete. The centre, though, was a tangle of sticks mixed with a little muck toward the outside edges. By October 8th, an entrance tunnel had been cut through the submerged foundation opposite the deep channel of the river to the floor of the "room" and the loose material from the centre removed by way of the tunnel. Another tunnel was also cut almost at right angles to the first. The inside aperture of this entrance was flush with the wall. The floor of the "room" was complete, covered with a layer of mud sloping slightly towards the entrance of the first tunnel whose inside aperture was flush with the floor. On October 10th, the beavers were harvesting and the beginning of a food pile made its appearance beside the lodge. At this time dry grass and shredded willow bark was found inside.

Presuming that the work on the lodge commenced on September 12th and terminated on October 9th, which I believe to be correct, the labour of 28 nights was expended on the structure.

Towards the end of October, after the conclusion of a late harvest, a quantity of loose sticks

were placed, butts downwards, about the sides of the lodge with the thin ends terminating across the apex. The apex, it should be said, was free of solid material, merely a network of sticks through which air filtered to the "room". When winter comes the welfare of the occupants of any beaver lodge can be ascertained by means of a wisp of vapour feathering through a hole in the snow above this efficient ventilator, telling of life within. Since this lodge was built it has assumed much larger proportions. In the spring of 1931, numerous sticks were thrust into the walls and covered with mud. In the autumn of 1931, a great deal more material was added than necessary to replace that lost by erosion during the summer. Owing to the lateness of the season when it was built the beavers were undoubtedly working against time and probably did no more than erect a habitation with a small margin of safety and comfort to meet the emergency that faced them.

The manner of lodge construction as shown by my observations proves conclusively that when building a habitation beavers do not leave the centre of the structure clear of accumulated material as the work proceeds, although the evidence is in favour of a deliberate intention to place little or no muck other than about the walls. I cannot say whether the floor of the lodge is made during the course of construction or after the "room" is formed, or if the inside walls of the "room" are finally covered with mud. Regarding the latter, I feel sure that no additional material is applied after the projecting sticks are cut flush with the walls and removed together with other interfering debris. In any event, a beaver lodge is a very masterful piece of work often given no more consideration regarding its technical details than an instinctively built bird's nest. There is, of course, no comparison.

Apart from lodges, every beaver pond on the Riding Mountain range includes one or more dens, visited by the beavers from time to time and probably used as hideouts when danger threatens. Burrowed in the banks of the pond at a place where the ascent of the slope is steep, they terminate in a "room", high above the water, large enough to shelter an entire beaver family. The entrance may be deeply submerged; often it is in shallow water approached by a canal, and sometimes above the surface at the water's edge. Investigation of the dens located at the sites under observation, and in many dry ponds, show that the roof of the "rooms" is from 18″ to 24″ below ground level, protected above by the roots of trees or shrubs in the same manner as the den behind the "bank" lodge at Site No. 1. They are generally some distance from the lodge. Never close by. I have one record of a beaver den excavated beneath a large granite boulder, the bottom of which is the roof. The length of the tunnels between the entrance and the rooms could only be roughly estimated. I would say that usually they are between 15′ and 20′ long, measured in a straight line from above.

A number of holes in the banks of the Vermilion river, and elsewhere in the Riding Mountain, indicate from the manner of their construction that they were excavated by beavers. As they were more or less remote from ponds there is some suggestion of occupation by migrants travelling down stream. Shredded willow bark was found in the "rooms" of more than one, together with peeled aspen-poplar sticks and other vegetable debris. It is quite possible that migrating beavers may even have survived a mild winter within these shelters, gathering food from day to day.

(To be concluded)

NOTES AND OBSERVATIONS

NIGHT ALARM.—On June 9th, 1929, at the north narrows of Moose Lake, Manitoba, I saw a bear (*Ursus americanus*) swim out just after dark to a long narrow island occupied by gulls and terns, and at its northern and nearer end only about one hundred yards from shore. In the darkness he could only be seen for a few feet after he left shore. However, pandemonium broke loose on the near end of the island, and gradually progressed along its length. After a while all was quiet again. Unfortunately I did not have an opportunity to visit the island and see if there were any signs of his passage.

The attitude of the bear throughout was that of one who had been there before.—C. H. D. CLARKE.

MOOSE SEEKS SHELTER FOR YOUNG. — Late in August, 1929, members of a forest survey

party with which I was employed found a cow moose with her calf on an island about a quarter of a mile off the south shore of Cedar Lake, Manitoba. The island was covered mostly by willows, and has an area of only a few acres. There were so many spots bedded down, and there had been so much browsing that the conclusion was reached that the old moose had come there to calve and remained on the island thereafter.—C. H. D. CLARKE.

THE RED-BREASTED NUTHATCH (*Sitta canadensis*) WINTERING IN MANITOBA.—Mr. Frank T. Farley's note on the Red-breasted Nuthatch wintering in Alberta, which appeared in *The Canadian Field-Naturalist* of March, 1935, page 61, is of more than passing interest because of recent records of this species in Manitoba.

The first record of a Red-breasted Nuthatch in winter here was made in December, 1933, when temperatures were very low, and snows very deep.

The second record was made here in January, 1935, and several more individuals and pairs were noted in February and March in widely separated woods of this district. In all cases these birds were seen in heavy mixed woods of balsam fir, white spruce, aspen poplar, and white birch.

A nest of the Red-breasted Nuthatch was discovered on Elks Island, five miles from Hillside Beach, Lake Winnipeg, June 23rd, 1934, in mixed woods. The nesting cavity, 20 feet up in a dead birch stub was coated near the entrance with balsam gum (see Reed's *Pocket Guide*).

The Red-breasted Nuthatch is a shy species at any time, and keeping as it usually does to heavy woods it is apt to be overlooked or its calls confused with those of the White-breasted Nuthatch (*Sitta carolinensis*). Can it be that *Sitta canadensis* is in reality a Permanent instead of a Summer Resident?—FRED J. ROGERS, *Hillside Beach, Lake Winnipeg, Manitoba.*

WOODCOCK FEEDING IN DAYLIGHT.—On April 22, 1934, the writer was climbing a step hillside on the east bank of the Don River at Toronto and was following the course of a small spring creek which had cut a deep groove in the bank when a Woodcock (*Philohela minor*) was flushed, flew a few yards and dropped back to earth, immediately becoming invisible, as is the way with Woodcock. I stood for a few minutes trying in vain to see the bird and was about to move on when it appeared from nowhere and after running a yard or two began to feed in the black, mucky soil bordering the spring. This was just before noon on a clear day and at a distance of less than 50 feet I watched it for two or three minutes with X8 bioculars, feeling conscious at the time that I was looking at something which I had never hoped to see and might never see again.

There was really little that was remarkable about the feeding actions of this particular Woodcock, as it walked about slowly, probing deeply with its beak quite like a Dowitcher or Stilt Sandpiper on a mud-flat. Two exceptional points were noted: often, though not each time, after inserting its beak full length in the soil, the bird remained perfectly motionless for several seconds and it seemed a reasonable supposition that at such times the flexible tip of the upper mandible [maxilla] was working; also, the mucky soil adhered freely to the beak and this was scraped off with one foot after nearly every withdrawal. At this distance I could see the earthworms clearly as they were pulled out. These were, of course, immediately swallowed. A slight movement on my part and the Woodcock ran a few feet to the top of a small dry mound where it crouched with the tarsi flat on the ground. Another step and it sprang into the air and disappeared among the second growth of the hillside.

The weather had been cold enough to freeze the surface soil for several nights prior to this date so that a logical explanation of this Woodcock's evident anxiety to feed by day would seem to be that this particular spot was receiving the full heat of the sun, making the soil quite soft and, as investigation showed, well populated with earthworms.—R. J. RUTTER.

THE FORCE OF EXAMPLE.—Regarding this matter in the December '35 issue of *The Canadian Field-Naturalist,* if Mr. Stuart L. Thompson will refer to my Birds of Hatley published in *The Auk,* vol. 33, 1916, p. 70 and *Auk* vol. 34, 1917, pp. 484-85, he will find that I have recorded the Ruby-throated Hummingbird, Myrtle and Black-throated Blue Warblers as having acquired the habit of sap drinking.—HENRY MOUSLEY, Montreal.

ACADIAN CHICKADEE. (*Penthestes hudsonicus.*)—The interesting compilation of "Christmas Bird Censuses, 1935" in *The Canadian*

Field-Naturalist for February, 1936, contains a single record (p. 24) of the occurrence of the Brown-headed (Acadian) Chickadee at St. Adèle, Terrebonne County, Quebec.

At Mille Isles, Argenteuil County, Quebec, a locality about midway between St. Jerome and Morin Heights, an Acadian Chickadee has been visiting our suet-boxes in the company of many Black-capped Chickadees and some Red-breasted Nuthatches. The first date upon which an Acadian and many Black-caps were seen together was January 1st, 1936. In taking turns at the suet, it has been noticed that the Nuthatches dominate the Chickadees. On December 14, a Blue Jay flew to a balsam fir in the garden and began peering about, then edged nearer to the centre of the tree and attacked a Black-cap, bringing it to the ground. It was taken into the house, where it remained stunned on the floor for half an hour, then flew up against a windowpane and crashed to the ground once more. I held it in my hand and felt its grip gradually tighten. I then fell into a doze with the bird in my hand. We woke up together and, when set at liberty, the patient flew off as if nothing had happened, circled around and returned to the original tree. About six weeks later, on February 3, a Blue Jay, perhaps the same one, was being pursued over the garden by a low-flying hawk, but the result of the chase was not witnessed.—A. WILLEY.

BOOK REVIEWS

THE PASSENGER PIGEON IN ONTARIO *by Margaret H. Mitchell. Contribution No. 17 of the Royal Ontario Museum of Zoology. Coloured Frontispiece, 5 maps, 6 illustrations and diagrams, pp.* 181. *Published under the Reuben Sells Leonard Bequest by the University of Toronto Press,* 1935.

A very important addition to our knowledge of this historical species. What the Buffalo was to the development of the Far West, the Passenger Pigeon was to the Middle West and the East, and they have suffered similar fates.

Though applying specifically to Ontario, the interest of this report is much broader than this geographical limitation. Much life history and incidental information have been saved from oblivion. It is founded upon a wide review of literature, old and new, (some 196 titles are cited in the bibliography) and returns from a large number of questionnaires from the rapidly decreasing ranks of those who can speak from first-hand experience. There is too much in this publication to be readily summarized but range, seasonal occurrence, nesting, habits and decline in this great Province are extensively treated and well documented. Nowhere else has so much information on this remarkable species been brought together. The author is to be complimented upon the thoroughness that has been brought to bear upon the task.

Of course no treatment of the Passenger Pigeon is complete without discussion of the cause or causes of the complete disappearance of its vast hordes within the space of a single generation. Ecological changes caused by settlement of the land, disease, man's destruction and market hunting are discussed as contributary causes but a new theory is advanced as to the immediate agent in the final catastrophy—an inability of the species to persist after a reduction in number below a certain minimum necessary to its success. It was a gregarious species, its whole economy adapted to congested associations of its kind, and could not function as efficiently in small scattered units as in large flocks. This reviewer, cannot help feeling that disease, perhaps foreign and introduced by domestic stock, may have had a larger part in the Passenger Pigeon debacle than is generally considered. We have ample analogy for this in other species. It seems that only some such agency is adequate to explain the continuance of depletion between the time when man's exploitation was unprofitable and the above results of under population became effective. Of course now this is purely a matter of speculation in which one opinion is no more demonstrable than another.

The subject, however, brings to mind a suggestion incidentally thrown out years ago, I believe by Dr. Vaughn of the University of Michigan Medical College. He called attention to the fact that "fever and ague", almost universal in the early days of settlement of the middle west, disappeared almost coincidently with the passing of the vast pigeon flocks. No definite connection was postulated but the more we learn of the transmission of parasitic disease by carriers, the more significant the coincidence becomes.—P.A.T.

FOUR PAPERS FROM THE ROYAL ONTARIO MUSEUM OF ZOOLOGY, TORONTO, ONTARIO.

It is gratifying to see that this, one of the youngest of museums is developing so rapidly and satisfactorily along both scientific and popular lines.

A New Genus and Species of Flightless Duck from Campbell Island by J. H. Fleming. Occasional Papers of the Royal Ontario Museum of Zoology, No. 1, *June* 22, 1935.

In this a new series of scientific papers makes its initial bow. We gather that it is designed for shorter technical subjects, original descriptions, revisions, etc. It is in convenient size for the book case, on good paper, well printed, and of dignified and workmanlike appearance.

This first paper in the series proposes a new genus as well as a new species, *Xenonetta nesiotis.* Campbell Island is one of the sub antarctic islands in the New Zealand region. The reviewer does not feel competent critically to evaluate the work in this widely extralimital group of aberrant ducks but the author presents a convincing case that has already aroused considerable interest in working specialists. We are glad to see a Canadian working in the broader field of world ornithology.

A Revision of the Sharp-tailed Grouse with a Description of a New Race by L. L. Snyder, ibid, No. 2, *July* 30, 1935.

Mr. Snyder is coming to the fore as a systematic worker. This revision is a result of the author's study of the remarkable Sharp-tail irruption in northern Ontario and Quebec during the winter of 1932-3. He postulates six recognizable races of the species, — *columbianus, kennicottii, campestris, campisylvicola* Subsp. nov., *phasianellus,* and *jamesi.* Of these, four are attributable to Canada; *phasianellus* about James Bay and Hudson Bay in Quebec, Ontario and adjoining Manitoba; *campisylvicola* the prairie and semi-prairies of Manitoba, Saskatchewan and Alberta; *columbianus* throughout British Columbia and southward; and *kennicottii* in central Alaska, Yukon and the Mackenzie Valley south to latitude 60°N. *Campestris* is restricted to the prairies south of the Canadian line. The reviewer has not the material at hand to judge the distinction between *campestris* and the new race but the other distinctions as they relate to Canada he is inclined to accept. The distributions of these races on the map accompanying looks convincing and logical and Mr. Snyder is to be congratulated on producing so promising a result in a difficult subject.

A Study of the Sharp-tailed Grouse by L. L. Snyder, Contributions of the Royal Ontario Museum of Zoology, No. 6, *Reprinted from the University of Toronto Studies, Biological Series No.* 40, 1935.

This is primarily a study of the remarkable increase in number and flight of the species into more southern parts of Ontario and Quebec in the fall and winter of 1932-3 but is far more than this. It includes discussion of the species as a whole, its history, habits and distinctions. The type form *P. p. phasianellus* inhabits the area about James Bay and southern Hudson Bay, usually in limited numbers, but is subject to the same cyclic increase as other grouse. In 1932 the swing of the cycle was phenomenal and the species spread in unprecedented numbers far south of its usual range to vanish again the succeeding season as mysteriously as it appeared. This case was quite parallel to the abnormal irruptions of Brunnich's Murre, Snowy Owl and Goshawk that have been reported in this country, and the Sand-grouse in Europe and the classical ones of the Lemming in Scandinavia.

Royal Ontario Museum Bulletin of Zoology, Bulletin No. 5. *February,* 1935.

Containing popular unsigned accounts of the Museum's notable collection of Passenger Pigeons and the new habitat group of the species. The former is largely due to the energetic efforts of Mr. Paul Hahn who has been untiring in discovering and acquiring specimens of this species in old mounted collections and elsewhere on behalf of the museum, where they will be carefully protected and come to their full scientific use instead of wastefully wending their way to destruction, the usual progress of stuffed birds in private hands.

The Pigeon Group illustrated in the Bulletin is a most creditable piece of work by the museum staff. It depicts a pioneer scene in a beech-maple forest clearing in the spring, with old wooden sap buckets and handmade spiles collecting sugar sap. Snow still lingers on the flats, the cabin of the early settler peeps over the rise and the hills bound the horizon. Pigeons are feeding in the foreground, others are just arriving. Overhead are dense flocks passing. The background is admirably painted with good atmosphere and blends well into the foreground. The accessories are well made and used effectively. Viewing it at ease and blotting out the modern surroundings one can well imagine that they have been transported backward many decades in time and are viewing a scene that must have been common in the early days of settlement but is now no more.—P. A. T.

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The Canadian Field-Naturalist

VOL. L OTTAWA, CANADA, MAY, 1936 No. 5

THE CANADIAN SNOWSHOE RABBIT INQUIRY, 1934-35.

By CHARLES ELTON and G. SWYNNERTON

(Prepared from material gathered by the National Parks Branch, Department of the Interior, Ottawa, and others, by CHARLES ELTON, Director of the Bureau of Animal Population, Oxford University, with the assistance of G. SWYNNERTON.)

1. INTRODUCTION

THIS IS the fourth annual report on fluctuations of the Snowshoe Rabbit or Varying Hare (*Lepus americanus*) in North America. It follows the methods of obtaining and mapping information from field observers already described in three previous papers in *The Canadian Field-Naturalist* 47:63-69, 83-86, 1933; 48:73-78, 1934; and 49: 79-85, 1935. There is no need to repeat a detailed account of these methods. It is sufficient to note that reports are obtained from a large number of observers who record their opinions of the comparative abundance of snowshoe rabbits from year to year. Each observer states the area in which he has worked during the previous twelve months (taken for convenience as those ending May 31st). This area is drawn in as accurately as possible on a large scale map, and the results later transferred to a smaller scale grid on the map of North America. The number of squares giving reports of *Increase, No Change, Decrease* and *Epidemic* form the main basis for a quantitative comparison of changes in the snowshoe rabbit population.

It was fortunate that the inquiries were started by the National Parks Branch of the Department of the Interior just as snowshoe rabbits were coming up to a peak of abundance in nearly all parts of Canada. This peak has now been passed, and most populations are on the downgrade or already very scarce, so that the records of the last four years give some picture of the culmination and decline of the ten-year cycle. In the present paper the results for the twelve months ending May 31st, 1935, are summarised, and the main events of the last cycle brought together in a condensed form.

The sources of information are as follows:—

1. 478 reports supplied by observers through the National Parks Branch,—exactly the same number as in the previous year. We are indebted to the Commissioner, Mr. J. B. Harkin and to the following whose services made this result possible: the Royal Canadian Mounted Police; the Game Officers of the Provinces of Canada; Honorary Game Officers and Holders of Scientific Permits under the Migratory Birds Convention Act; Taxidermists; Superintendents and Wardens of the National Parks, and other observers throughout the country. We wish to put on record the high standard of the reports and the care with which they have been put together at National Parks headquarters for our use.
2. Annual zoological reports from the Hudson's Bay Company (of which 116 contained relevant information about snowshoe rabbits). We have to thank the Governor, Mr. P. Ashley Cooper, and the Committee of the Company for permission to use these reports and also some for earlier years; and the Fur Trade Commissioner in Winnipeg, Mr. Ralph Parsons, for his continued interest and help.
3. 29 reports made by fishery officials working in the Maritime Provinces under the Biological Board of Canada. The officer of the Board who handled these was Dr. A. G. Huntsman.
4. A report from Anticosti, in the Gulf of St. Lawrence, kindly sent by Mr. C. R. Townsend, Factor of the Consolidated Paper Corporation Ltd., at Port Menier, Anticosti.
5. The Department of Natural Resources of Newfoundland is supplying information from its Supervisors. These have not been received in time for the present report, but will, it is hoped, be included in the next one. We have to thank Mr. Gower Rabbitts, in charge of Game and Inland Fisheries, for arranging the inquiry in Newfoundland.

6. This year 8 reports were received from Alaska, through courtesy of the U.S. Bureau of Biological Survey and the officers of the Alaska Game Commission. We wish to thank in particular Mr. Frank Dufresne for obtaining further reports from the resident Game Wardens.

7. The U. S. Bureau of Biological Survey in Washington have coöperated this year in extending the inquiry into the United States, from which 49 reports have been received—a matter for satisfaction, since it shows that the methods employed in the Canadian inquiry have met with approval elsewhere, and also

Fig. 1. *State of the snowshoe rabbit population in* 1934-35. *Dotted areas are groups of squares overlapped by areas of observers reporting relative INCREASE in* 1934-35 *over* 1933-34. *Dotted areas in Alaska and Anticosti are actual areas reporting increase. Larger black dots are Hudson's Bay Company posts etc.* (1927 *map,*) *Broken lines in Canada show main vegetation zones. Broken lines in United States show approximate limits of snowshoe rabbit species and subspecies. Thick black lines are Province or State boundaries.*

because we are now enabled to cover sample patches of a large part of the whole range of the snowshoe rabbit in North America. For this coöperation we have to thank Mr. J. N. Darling, late Chief of the Bureau. The organization of the inquiry in Washington has been carried out under Dr. W. B. Bell, Chief of the Division of Wildlife Research, whose help we wish to acknowledge. We also wish to thank Mr. Herbert L. Stoddard, who gave important assistance by carrying out preliminary negotiations in Washington. The reports are from the survey's Game Protectors and people in touch with them; they are referred to in more detail later.

The total material available, therefore, consisted of 573 reports from Canada, United States and Alaska, arranged on a standard pattern (for questionnaire see the first report of this series). The original full data are deposited at the Bureau of Animal Population in Oxford. Duplicates of the National Parks of Canada Branch questionnaire replies, of the detailed maps for provinces, and of the main maps reproduced in a reduced form here, are being deposited with the National Parks Branch at Ottawa. Duplicates of the United States reports are filed in the U. S. Biological Survey at Washington, where also copies of the detailed maps for various states will be placed. It goes without saying that a very large amount of valuable information about snowshoe rabbit habitats, years of abundance and scarcity, epidemics, and also notes on predatory animals and birds is contained in these reports and cannot be summarised in a short paper. It is for this reason that they are, as far as possible, being made available for reference by workers on both sides of the Atlantic.

In Oxford we have to thank particularly Mrs. Jane Baden-Powell for valuable help in preparing maps for record; and Mr. Dennis Chitty, who assisted with mapping the Ontario and Quebec material and suggested some improvements in technique. Throughout the investigation the advice of Mr. Hoyes Lloyd of the National Parks of Canada Branch has been greatly appreciated. The Dominion Bureau of Statistics has also given important assistance.

2. METHODS

Our aim is, as far as possible, to transfer the records (*i.e.* the opinions) of observers about population changes onto maps without introducing any important bias of our own into the re-

TABLE 1

State of the Snowshoe Rabbit population in Canada, 1934-35 (*numbers of squares*).

	Total	Increase	% Increase	Decrease	% Decrease	No Change	% No Change	Epidemic	% Epidemic
Yukon	34	31	**91**	3	**9**	0	**0**	0	**0**
Northwest Territories .	207	166	**66-80**	45	**10-22**	10	**3-5**	16	**8**
British Columbia . .	181	121	**42-67**	84	**23-46**	39	**7-22**	21	**12**
Alberta	184	62	**17-34**	119	**53-65**	44	**8-24**	56	**30**
Saskatchewan	143	43	**3-30**	127	**58-89**	35	**5-24**	71	**50**
Manitoba ...	196	62	**14-32**	153	**57-78**	28	**7-14**	41	**21**
Ontario	313	90	**13-29**	259	**58-83**	51	**3-16**	37	**12**
Quebec	238	74	**20-31**	172	**56-72**	32	**6-13**	88	**37**
New Brunswick .	25	9	**28-36**	12	**16-48**	12	**24-48**	4	**16**
Nova Scotia .	27	21	**37-78**	14	**22-52**	6	**0-22**	6	**22**
TOTAL	1548	679	**27-44**	988	**43-64**	257	**6-17**	340	**22**

sults. The methods employed do largely achieve this aim, in two ways. First, the areas of observers are mainly mapped automatically and could be entirely so if the reports stated with sufficient precision the areas covered during the year. In practice the areas are not always described in such a way that they can be exactly transferred to a map. *Observers are earnestly asked to remember to do this every year, and to describe the limits of their areas exactly, in such a way that these can be mapped without error by someone unfamiliar with the local features. The ideal method is to mark in the areas on a sketch map and return this with the*

FIG. 2. *State of the snowshoe rabbit population in* 1934-35. *Vertical hatched areas are groups of squares overlapped by areas of observers reporting relative DECREASE in* 1934-35 *over* 1933-34. *Horizontally hatched areas, NO CHANGE. Large black dots are Hudson's Bay Company posts, etc.* (1927 *map*). *Broken lines in Canada show main vegetation zones. Broken lines in the United States show approximate limits of snowshoe rabbit species and subspecies. Thick black lines are Province or State boundaries.*

reply. This is one of the ways in which field observers can most effectively help to maintain the high standard required in mapping animal population on a large scale. The second point is that whatever errors are introduced tend largely to cancel one another out, *i.e.*, they will occur at random in mapping "more", "less" and "no change". To make this second safeguard effective, it is necessary, however, to avoid mapping very large areas which may give undue weight to the opinion of one or two observers. For this reason any reply covering an area more than 50 miles across is considered very carefully, and usually used for reference but not actually mapped unless it is clearly the result of some large-scale inquiry canalizing the observations of a number of other people. For the Northwest Territories of Canada very large areas are mapped, however. The Hudson's Bay Company results are first mapped as circles with a 50-mile radius (100 miles diameter) and then transferred to the main grid of 30-mile squares. National Parks of Canada Branch, Biological Board of Canada, and United States observations are happed on large-scale maps of provinces and states and transferred to the main grids. These were done on two different maps, for reasons of convenience: the Canadian map being that previously used, and the United States map being based on the polyconic projection, 1/7,000,000, relief map published by the U. S. Geological Survey, 1934. The two have been photographed down to about the same scale. The results for Alaska and Anticosti are mapped as returned, and are not transferred onto any grid.

In weighing up the reliability of these annual maps there are obviously two main considerations: the accuracy of the observations and the accuracy of the mapping methods. We believe that the mapping methods, though subject to certain errors, are sufficiently exact for the purpose. The accuracy of the comparative field observations is proved by the consistent picture they give and the large extent to which many observers agree in their description of what is happening over large areas.

3. RESULTS: 1934-35.

CANADA. The three maps (Figs. 1-3) show the distribution of areas reporting *More, Less, No change* and *Epidemic* in 1934-35. The figures for the various provinces are summarised in Table 1. The fact that two figures are given for many of the percentage values is due to the existence of overlapping, *i.e.* to the fact that a number of squares contain records for more than one category. Some of these overlaps represent real differences of opinion between people working over the same ground; others are only apparent owing to different areas covering different parts of the same square—for it has to be remembered that a square is filled in completely even if only a small portion of the observer's area enters it. This exaggeration of the original areas, involved in the grid method, has already been discussed in previous reports, where it was shown that the method about doubles the original areas but that this probably does not greatly affect the comparative values for different categories. The real percentage value lies somewhere between the two given in the table.

It can be seen at once that this was a year of "crash" in the Middle West and East of Canada, while the Northwest (Yukon, Northwest Territories, and northern British Columbia) was still on the increase and had not yet begun to decline much. For Canada generally the maps for 1931-32 and 1932-33 showed a negligible area of *Decrease* (0-7% and 4-10% respectively). In 1933-34 this had swelled to 17-31%. In 1934-35, 43-64% of the country was reporting decrease. Alberta, Saskatchewan, Manitoba, Ontario and Quebec, all show *minimum* figures of over 52%. The *Increase* values have changed in an inverse manner, dropping from nearly 100% in 1931-32 to 27-44% in 1934-35.

A regional grouping of the provinces brings out rather clearly the situation in 1934-35. The number of squares grouped into three regions is as follows:

	Total	Increase	Overlap	% Increase
Yukon Northwest Territories British Columbia	422	318	74	*57-75*
Alberta Saskatchewan Manitoba	523	167	116	*22-32*
Ontario Quebec	551	164	76	*16-30*

The differences would be still more striking if the regions chosen were more natural ones *e.g.* if northern British Columbia and Alberta were separated from their southern parts. But there has not been time to carry out such refinements, as the questionnaire replies inevitably cannot be received until the early winter, and the mapping and analysis takes two or three months.

In the previous report (for 1933-34) it was pointed out that the sudden increase in conflicting reports indicated the point at which rabbits were reaching saturation, or approaching at any rate high numbers where it would be difficult to observe increase or decrease. The percentage of *No change* reports was higher in that year than it was before or than in the season of 1934-35. The *Epidemic* percentage (22%) is about the same as in the two previous seasons (16%, 19%) but there has been a trend of increase. Practically no epidemics were reported in 1931-32. There is no doubt that we are witnessing an enormously widespread decline in the snowshoe rabbit population, the development of which can be followed fairly exactly in the maps for these last four years. The statistical results discussed here are backed by a very large number of accounts from observers. A few of the replies are given below. They are only a selection from very rich and interesting material.

Hay River Post (H.B.Co.), Great Slave Lake, Northwest Territories:

"At the beginning of the Outfit (*i.e.* June 1934) rabbits, coloured foxes and lynx were fairly plentiful, but about Christmas the rabbits seemed to thin out considerably and there was a general migration of foxes and lynx in a northwesterly direction . . . In the summer of 1935 rabbits were very scarce . . . .".

Northern Alberta, (Townships 80-101, *Ranges* 19-24. H. G. Lowes, R.C.M.P.):

"Much less. Sudden decrease last year and no increase noticed this year. Only thing noticed unusual was that rabbits bunched together in hundreds and died last year. They were so scarce this year that they were hardly noticeable. A stray one was noticed from time to time during the winter.'

Buffalo National Park, Alberta. (West and North sections, and Park reserve sections on west side of Park and East of Battle River. E. J. Cotton, Warden):

"Very few seen: these were in dense willows, in slough and river bottom lands. Scarce since last season. During summer and fall months (1935) animals were infected and died out to a considerable extent. Last May carcasses were frequently found, also animals in a dying condition. They were thin and ragged and the body and head were covered with small egg-like appendages."

Edmonton, Alberta, and 50 miles round it. (Prof. William Rowan, University of Alberta):

"Noticeable reduction in numbers during November, 1934. Stationary during winter in spite of severe weather conditions. Numbers in May, 1935, only slightly below those of May, 1934. Epidemic in November, 1934: of some 250 rab-

TABLE 2.

State of the snowshoe rabbit population in the United States, 1934 35.

	No. of observers	Total no. of squares	Increase	% Increase	Decrease	% Decrease	No change	% No change	Epidemic	% Epidemic
Maine	1	24	0		24		0		0	
New Hampshire	1	9	0		9		0		0	
Michigan	1	9	0		4		0		4	
Minnesota	2	3	2		1		0		1	
Total (*L. americanus*)	6	40	2	5	38	95	0	0	5	13
Washington	2	15	0		0		5		0	
Idaho	1	14	2		8		15		8	
Montana	2	15	10		4		2		0	
Wyoming	12	25	7		2		22		0	
Colorado	2	19	6		13		5		0	
Total (*L. bairdi*)	19	88	25	24-35	27	23-31	49	43-56	8	9

bits examined during the fall and winter no case of tularaemia was encountered and all injections into guinea pigs were entirely negative. Some of these rabbits were very emaciated and in very poor condition. Tapeworms cysts plentiful, but not universal. Tuberculosis identified in several cases. In many cases no diagnosis of obvious diseased condition was successfully made. Horned owls still superabundant . . . . ."

Southern Alberta. (Valley of Elbow and Bow Rivers through the Sarcee Indian Reserve and adjacent to the villages of Priddis and Bragg Creek. F. L. Sara):

"An increasing demand for rabbits by the fox ranches, locally, has developed quite a winter industry, particularly around Bragg Creek, which was shipping out approximately a ton of rabbit carcasses each ten days during winter months. This trapping has been systematic, but instead of depleting the number of rabbits in the area, they appear to be just as many each fall. I have been watching with interest for a recurrence of rabbit disease but over a period of four years no trace of this epidemic has been manifest. Query, would the constant trapping have any effect in maintaining the stock in a more virile condition? I saw no marked increase this year."

Northern Saskatchewan, (Townships 62-66, Ranges 15-22, W. 3rd Meridian; R. Higman):

"During the years 1932-33 and up to March, 1934, snowshoe rabbits have been more scarce than for several years."

Berens River Post (H.B.Co.), Lake Winnipeg, Manitoba:

"Hardly a rabbit left in this vicinity in the spring, whereas for the past two years they were extremely plentiful."

Mistassini Post (H.B.Co.), Central Quebec:

"In some sections where our natives trap, rabbits have almost disappeared.'

James Bay. (From mouth of Moose River, Ontario, to 20 miles inland and coast line of James Bay from Moose River to Rupert's House on E. side, from Moose River to Albany on W. side. L. W. Hopkins, R.C.M.P.):

FIG. 3. *Epidemics among snowshoe rabbits. Dotted areas are groups of squares overlapped by observers reporting EPIDEMICS in* 1934-35. *Larger dots are Hudson's Bay Company posts etc.* (1927 *map*). *Broken lines show main vegetation zones. Thick black lines are Province boundaries.*

"In swampy bush country, where balsam, spruce, willows and tamarack grow. Less abundant. Decrease began in February, but cause not known. This might be attributed to an increased number of foxes through this area. No diseased specimens have been reported. From Attawapiskat, Ont., to Moose Factory, and from Moose Factory around Hannah Bay to Point Comfort, P.Q., there has been a marked decrease. Although a slight decrease was noticed in Rupert's Bay it was not serious."

There is a large mass of useful information about habitats, epidemics, parasites, and some specially valuable notes on predatory animals and birds. These are available in the files and it is hoped that biologists will make use of them.

ALASKA. Mr. F. Dufresne reports (Autumn, 1935) that "Although none of the areas under discussion (Fort Yukon, Fairbanks, McGrath, Anchorage, Cordova) show signs of sudden decreases, information has come to this office that the rabbits in the Iliamna—Bristol Bay district have declined in numbers, and it is believed that the rabbit cycle in Alaska is now at or near its cyclical peak.' Mr. Otto W. Geist of University of Alaska, College, Alaska, reports (October 18th, 1935) that "It is now near the end of October and snowshoe rabbits (varying hare) are plentiful. While walking along the railroad track from Fairbanks to the University of Alaska on October 16th at about midnight, I counted over 25 white or nearly white ones within the short distance of 3 miles. These I actually saw, but I also heard several running over dry and frozen leaves when I did not actually see the animals. It is safe to say they are quite plentiful yet . . . .". Charles H. Rouse, Assistant Biologist, Biological Survey Experiment Station, Fairbanks, reports (November 4th, 1935) snowshoe rabbits not yet decreasing, and that no epidemic had been noticed, although a number were heavily infested with wood ticks, *Haemophysalis leporus-palustris* in May and June 1935.

TABLE 3.

Total numbers of lynx, red fox and marten skins taken in the whole of Canada.

(Dominion Bureau of Statistics figures)

Season	Lynx	Red Fox	Martens
1919-20	9,499*	30,317	56,977
1920-21	6,509	18,137	47,292
1921-22	11,673	38,024	58,989
1922-23	17,317	42,739	45,579
1923-24	26,437	65,986	47,407
1924-25	29,608	82,610	41,504
1925-26	33,054	90,745	36,940
1926-27	28,706	74,391	42,048
1927-28	21,369	53,671	38,058
1928-29	11,604	37,964	34,497
1929-30	7,921	28,719	27,396
1930-31	7,976	28,671	25,879
1931-32	8,454	36,643	21,925
1932-33	11,932	52,765	23,725
1933-34	16,799	81,513	17,660
1934-35			†(c. 20,000)

* Includes a certain number of "wild cats".
† Provisional figure.

Previous records and some fur statistics recently obtained show that Alaska has a similar rabbit cycle to Canada, and it seems certain that this or the next winter will have witnessed the beginning of decline.

UNITED STATES. The snowshoe rabbit situation in the United States is complicated by the existence of several species and subspecies occupying separate isolated areas. The most important, and the only places from which reports have been received this year, are the Rocky Mountain area occupied by *Lepus bairdi*, which lives in mountain forests from 8,000 to 11,000 feet in Idaho, Montana, Washington, Oregon, Wyoming, Utah, Colorado and New Mexico; and the north-eastern forest area of Minnesota, Wisconsin, Michigan, New York, Pennsylvania, and New England generally (extending south into the mountains of West Virginia and Virginia) occupied by subspecies of *L. americanus* itself. (*L. a. phaconotus, struthopus* and *virginianus*). There are also certain extreme western forms for which data are not available this year. The ranges of the different species and subspecies have been sketched on the maps (Figs. 1 and 2): these are only very approximate, being taken from E. W. Nelson's monograph (*North American Fauna*, No. 29, 1909) adjusted in certain cases to cover the present records. These areas are marked in, more in order to

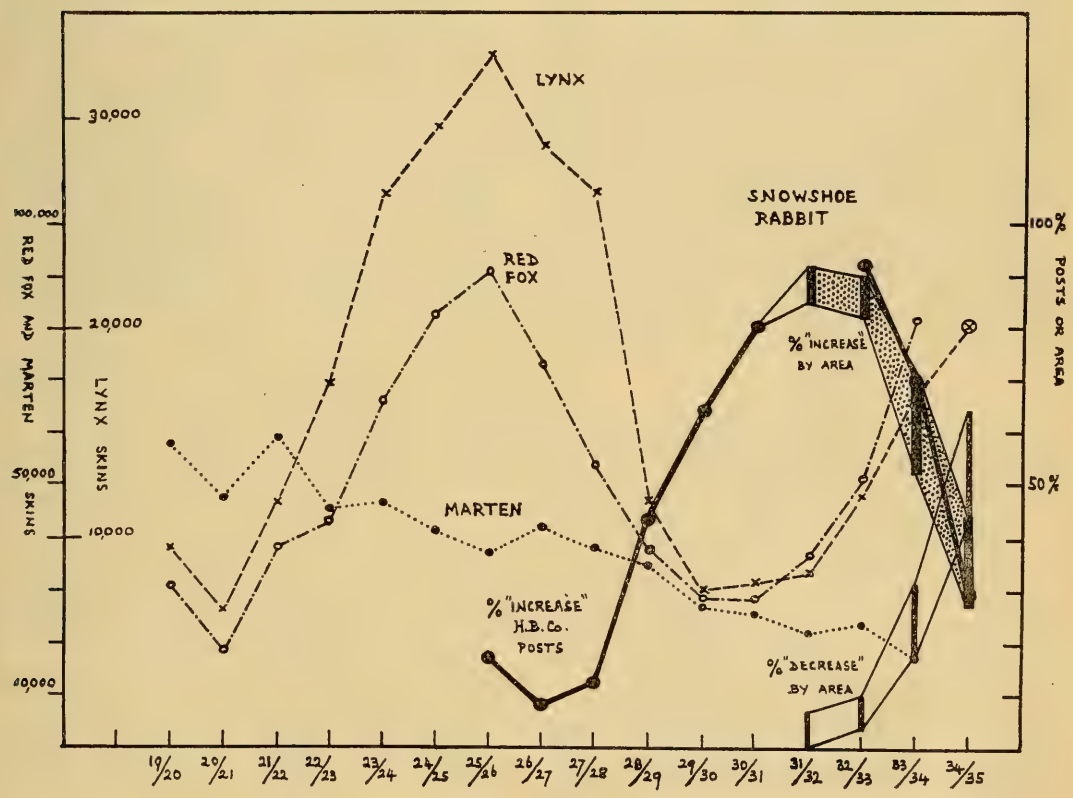

FIG. 4. *The ten-year cycle in snowshoe rabbits and predatory furbearers (lynx, red fox, and marten). Snowshoe rabbit: large black dots and thick connecting line show percentage of Hudson's Bay Company posts reporting INCREASE (report for 1931-32 missing); thick vertical lines, with area dotted, cover limits of values for percentage areas in Canadian Snowshoe Rabbit Inquiries reporting INCREASE (including National Parks Branch results for four years, H. B. Co. for last three years, and Biological Board of Canada for last year); thin vertical lines ditto for percentage DECREASE. Predators: from Dominion Bureau of Statistics figures; Lynx figures for 1934-35 provisional.*

show the general situation than to provide any exact map of the modern range of the species. Planimeter measurements show that these range limits cover an area of something like 580,000 square miles, much of which, however, is occupied by high mountain country or other unsuitable ground. Since there must, however, be a very big population of snowshoe rabbits in the United States, it was of special interest to try and find out to what extent they take part in the same cycle as those in Canada. This was the chief object of extending the inquiry to the United States. The fact that we are able to study the changes in population of a group of rodent species over a large part of their total range, holds potentialities for general biological study. The results of the inquiry, so far as they could be mapped, are given in Table 2. The number of observers was much smaller than in Canada, but some of them covered rather large areas in their travels as Game Protectors, Game Wardens or Foresters, and part of their information comes from others. The results, though based on small figures, are of interest in two respects. First, for the eastern snowshoe rabbit population 95% of the squares report *Decrease*. The reports for Maine and New Hampshire are particularly definite and circumstantial. They are confirmed by others in Michigan and Minnesota. In Maine the decrease apparently began two years ago and has been very rapid and widespread. In this connection we may note the important series of ecological and pathological reports by Dr. R. G. Green and Dr. J. E. Shillinger, for the Lake Alexander area of Minnesota, published in mimeographed form as the *Minnesota Wild Life Disease Investigations*. These form the most important detailed field observations on the snowshoe rabbit cycle, especially in relation to tick infestation and tularaemia, that have so far been done. It is realised that there is a large amount of information also available in game surveys past and current, but it is impossible here to do more than acknowledge the fact.

The second conclusion that stands out is the comparative stability of the *Lepus bairdi* populations in the mountain forests of the West. This is shown by the high percentage of *No change* figures (43-56) and is confirmed by a number of very definite statements that snowshoe rabbits in these regions fluctuate very little. The only region reporting any marked increase is Montana, and the only place reporting epidemic is Idaho. It was not thought worth while to reproduce a special map for epidemic areas which cover two patches in Minnesota and Michigan and one in southwest Idaho.

TABLE 4.

Snowshoe rabbit reports from Hudson's Bay Company posts.

Season (ending May 31st)	Total posts	Increase	% Increase	Decrease	% Decrease	No Change	% No Change
1925-26	18	3	**17**	15	**83**	0	**0**
1926-27	25	2	**8**	20	**80**	3	**12**
1927-28	35	5	**14**	29	**83**	1	**3**
1928-29	53	23	**43**	25	**47**	5	**10**
1929-30	66	42	**64**	19	**29**	5	**7**
1930-31	69	55	**80**	11	**16**	3	**4**
1931-32 (no records)	—	—	—	—	—	—	—
1932-33	119	109	**92**	6	**5**	4	**3**
1933-34	121	84	**69**	29	**24**	8	**7**
1934-35	116	34	**29**	79	**68**	3	**3**

The full details of these reports will be published elsewhere. The present summary makes it probable that the *Lepus americanus* population as a whole is under the influence of the northern ten-year cycle, both in Canada and in the United States, and the present method of mapping enables statistical comparisons to be made of the fluctuations of the different populations. It seems at any rate that the rabbits have "crashed" during the last two years on both sides of the International Boundary. It is also of importance to follow up the question of the mountain populations of *Lepus bairdi* farther west, and to confirm the supposition that they are comparatively stable, as appears to be the case, and to find out whether this is due to the density being always rather low, as is suggested for a good many localities.

4. THE TEN-YEAR CYCLE

Sufficient material has now accumulated to make it worth while to summarise the events of the last few years (Fig. 4). The fur returns (Dominion Bureau of Statistics) for the whole of Canada for lynx, red fox and marten are shown, from 1919-20 nearly up to date (Table 3). The latest figure for the lynx is a provisional one kindly supplied by the Bureau. Red fox means literally the red phase only of the coloured fox, as this was a convenient index of the species (which includes also cross and silver), and eliminates most of the fox farm figures. The cycle of about ten years in lynx and red fox is clearly shown, also the lack of any cycle in the marten, which has gone steadily down to about a third of the catch for 1919-20. Now, the marten used to be one of the furbearers showing the most conspicuous ten-year cycle, as can be seen from the figures in C. G. Hewitt's *"Conservation of the wild life of Canada"* (1921 p. 225). After about 1900 the cycle gradually broke down and this is probably connected with overtrapping. It is a little alarming to note the sluggish way in which lynx is recovering during the present cycle, but that may turn out to be only an accidental feature.

The snowshoe rabbit figures in the diagram are from two sources. The reports from Hudson's Bay Company posts since 1925-26 form an earlier record, not so far published, of which the details are given in Table 4. The number of posts reporting during the first two years may be too small for the percentage differences to be significant. But the estimates of the last snowshoe rabbit maximum given in the snowshoe rabbit inquiry report for 1931-32 (*Canadian Field-Naturalist* 47:85, 1933) were 1923-25, which agrees in a general way with the minimum period being in 1926-28. No H. B. Co. reports were received in 1931-32, when the National Parks Branch inquiry began. The figures for percentage areas reporting *Increase* and *Decrease* are plotted on the diagram by vertical bars instead of points, owing to the value for each year lying between two limits. The wide bars show *Increase* and the spaces are dotted in, the narrower bars show *Decrease* and the spaces are blank. The figures are those already published in this Journal and need not be repeated.

There is a marked parallelism between lynx, red fox, and snowshoe rabbit, and it is apparent that the snowshoe rabbit inquiry should provide a firm basis for forecasting the general trends of some of the furbearing animals. The peak in lynx and red fox ought to occur in the winter of 1935-36 or 1936-37. Of course, it is realised that we are not comparing exactly homogeneous data, since the richest areas for fur bearing animals are not necessarily at the present day the most important snowshoe rabbit districts, and there are important regional lags in rise and decline.

SUMMARY

Altogether 673 reports were received for 1934-35 and most of these have been mapped. They cover most of Canada (including Anticosti) and sample areas of Alaska and the United States. In the Northwest rabbits were still increasing and abundant. Over much of the rest of Canada a steep decline had set in, partly associated with epidemics. Rabbits in the Northeast United States had also declined in numbers. Those in the Rocky Mountain areas were stable or showed no consistent regional trend, except for increase in Montana. The figures for previous years, summarised with trends in furbearer catches in Canada, show a well-marked cycle of about ten years.

Since this report was completed information comes from Newfoundland Game and Inland Fisheries that snowshoe rabbits appeared to be scarcer during 1935 than in 1934, in most sections where they are generally hunted. It is not known whether this was due to natural causes only.

ROTIFERS FROM THE LAURENTIDES NATIONAL PARK WITH DESCRIPTIONS OF TWO NEW SPECIES

By FRANK J. MYERS, F.R.M.S.

THE FOLLOWING list is based on a number of collections made during the month of August, 1935, while on an automobile trip through the Laurentides National Park, Quebec.

The park lies on the Laurentian Plateau, its southern limit being about twenty-five miles from the city of Quebec, from where it extends northward for somewhat over one hundred miles.

The terrain is a plateau with an uneven rolling surface, the elevation varying from 500 to 2,000 feet. It is a hard-rock area, plained by glacial action which has left its mark in the innumerable bodies of water both large and small. The rocks are for the most part Precambrian and of igneous origin, those predominating being granites and granite-gneisses. As is generally the case with such geological formations, the water is acid and the hydrogen-ion concentration (pH) of the various bodies of water varies from 5.2 to 6.8.

Running almost through the middle of the park in a northerly direction is the only road that is fit for automobile traffic. It was along this route that collections were made. No specific locations are given, suffice it to say that collecting was done near the highway, along branches of the Riviere Jacques-Cartier, and neighbouring lakes and ditches among *Sphagnum, Fontinalis* and other aquatic vegetation.

A complete picture of the rotatorian fauna of the region cannot be given, as none of the material was narcotized, so that only a small proportion of the contractile forms were recognizable. However, under the action of caustic alkali the toes of many of these forms are forced out. The trophi are cleared during the process and these, together with the toes, frequently enable one to determine many species with accuracy. The loricated forms were abundant and furnished interesting material. The fauna agrees well with that of northern Wisconsin, southern New Jersey and Mount Desert Island, Maine, all of which are acid water associations.

Collections were made by washing aquatics in a concentrating net and adding a small amount of formalin coloured with aqueous eosin after the concentrate was transferred to 50cc. containers. The eosion stains rotifers and other small animal forms a dark pink but has no effect on cellulose plant material and other detritus, thus enabling the rotifers to be picked out more easily.

There has been very little faunistic work done on the rotatorian fauna of Canada. Only two such works having appeared; those of Murray (1911), and Odell and Harris (1933). The former deals with the order Bdelloidea exclusively, enumerating 42 species; the latter is a faunal list compiled from collections made in the Ottawa district, and 82 species are listed, most of which belong to the alkaline and transcursion faunae. Only 26 species are common to the following list and that of Odell and Harris.

FAUNAL LIST

Aspelta beltista Harring and Myers.
" *circinator* (Gosse)
Asplanchnopus dahlgreni Myers
Cephalodella apocolea Harring and Myers.
" *auriculata* (Müller)
" *exigua* (Gosse)
" *forficata* (Ehrenberg).
" *gibba* (Ehrenberg)
" *megalocephalia* (Glasscott)
" *mucronata* Myers
" *tenuior* (Gosse)
Conichilus hippocrepis (Schrank)
Conochiloides dossuarius Hudson
Colurella bicuspidata (Ehrenberg)
" *obtusa* (Gosse)
" *sulcata* (Stenroos)
" *tesselata* (Glasscott)
Dapidia deflexa (Gosse)
" *calpidia* Myers
Dicranophorus epicharis Harring and Myers
Dissotrocha aculeata (Ehrenberg)
" *maculata* (Ehrenberg)
" *tuberculata* (Gosse)
Diurella brachyura (Gosse)
" *cavia* (Gosse)
" *collaris* (Rousselet)
" *intermedia* (Stenroos)
" *porcellus* (Gosse)
" *porcellus* var. *carinata* Harring
" *stylata* (Eyferth)
" *sulcata* (Jennings)
" *tenuior* (Gosse)
" *tigris* (Müller)

Diurella uncinata Voight
" *tortuosa* Myers
Encentrum felis (Müller)
Eothinia elongata (Ehrenberg)
Erignatha clastopis (Gosse)
Euchlanis dilatata Ehrenberg
" *mencta* Myers
" *parva* Rousselet
" *pellucida* Harring
" *triquetra* Ehrenberg
Floscularia ringens (Linnaeus)
" *janus* (Hudson)
Keratella cochlearis (Gosse)
" *paludosa* (Lucks)
" *serrulata* (Ehrenberg)
Lecane aquila Harring and Myers
" *arcula* Harring
" *brachydactyla* (Stenroos)
" *clara* (Bryce)
Lecane fusilis, **new species**
" *flexilis* (Gosse)
" *intrasinuata* (Olofsson)
" *levistyla* (Olofsson)
" *ligona* (Dunlop)
" *luna* (Müller)
" *mira* (Murray)
" *sympoda* Hauer
" *niothis* Harring and Myers
" *pycina* Harring and Myers
" *pyrrha* Harring and Myers
" *satyrus* Harring and Myers
" *signifera* (Jennings)
" *stichaea* Harring
Lepadella acuminata (Ehrenberg)
Lepadella canadaensis, **new species**
" *cristata* (Rousselet)
" *ovalis* (Müller)
" *patella* Ehrenberg
" *triptera* Ehrenberg
Lindia pallida Harring and Myers
Monommata caudata Myers
" *enedra* Myers
" *diaphora* Myers
" *grandis* Tessin
" *hyalina* Myers
" *orbis* (Müller)
Monostyla bulla Gosse
" *closterocerca* Schmarda
" *crenata* Harring
" *elachis* Harring and Myers
" *hamata* Stokes
" *lunaris* Ehrenberg
" *pygmaea* Daday
" *quadradentata* Ehrenberg
Notommata apochacta Myers
" *codonella* Harring and Myers
" *copeus* Ehrenberg
" *cyrtopus* Gosse
" *doneta* Harring and Myers
" *epaxia* Harring and Myers
" *pachyura* (Gosse)
" *pachyura* var. *triangulatus* Kirkman
" *pseudocerebrus* de Beauchamp
" *saccigera* Ehrenberg
Platyias quadracornis (Ehrenberg)
Pleurotrocha robusta (Glasscott)
Ploesoma lenticulare Herrick
" *triacanthum* (Bergendal)
" *truncatum* (Levander)
Polyarthra trigla Ehrenberg
Prolaes decipiens (Ehrenberg)
" *sordida* Gosse
Pseudoecistes rotifer Stenroos
Rotaria macrura (Ehrenberg)
Resticula melandocus (Gosse)
Scaridium longicaudum (Müller)
Squatinella longispinata (Tatem)
" *mutica* (Ehrenberg)
" *tridentata* (Fresenius)
Stephanoceros fimbriatus (Goldfuss)
" *millsii* (Kellicott)
Taprocampa annulosa Gosse
" *selenura* Gosse
Testudinella dicella Myers
" *incisa* (Ternetz)
" *parva* (Ternetz)
" *patina* (Hermann)
Tetrasiphon hydrochora Ehrenberg
Trichocerca elongata (Gosse)
" *iernis* (Gosse)
" *longiseta* (Schmarda)
" *lophoessa* (Gosse)
" *rattus* (Müller)
" *rosea* (Stenroos)
Trichotria pocillum (Müller)
" *tetractis* (Ehrenberg)
" *truncata* (Whitelegge)

ORDER MONOGONONTA

FAMILY BRACHIONIDAE

Lecane fusilis new species

The lorica is obovoid, truncate anteriorly, membranous and quite flexible. The anterior margins are coincident and slightly convex; no anterior spines are present. The posterior segment is subcircular and projects far beyond the limit of the dorsal plate. No lateral sulci are

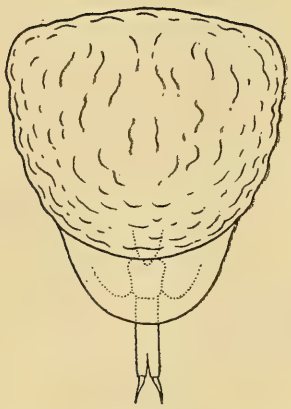

Fig. 1. *Lecane fusilis,* dorsal view.
In order to avoid duplication of figures, dotted lines indicate ventral features.

present. The coxal plates are rather small and obtusely pointed; they do not reach beyond the second foot joint. The first foot joint is elongate, rather narrow and somewhat indistinct; the second joint is large and subsquare. The toe is of median length and quite stout; it is fused for two-thirds of its length and terminates in two long slender claws.

Length: dorsal plate 52; ventral plate 63; toe 24; claws 8. Width: lorica, (widest part) 58. (Measurements in micro-millimeters).

Lecane fusilis was found to be quite rare. It belongs to that group within the species characterized by a partial fusion of the toes, exemplified by such species as: *L. inopinata* Harring and Myers, *L. elasma* Harring and Myers, *L. sympoda* Hauer and *L. agilis* Bryce. In addition to those, I have received sketches of several others, as yet undescribed, found in collections from Java and Sumatra, and kindly sent to me by Herr. J. Hauer, Karlsruhe, Baden.

It is the definite transition between the toes of the otherwise identical genera *Lecane* and *Monostyla* which prompted Edmondson (1935) to propose the union of the two genera under the name of *Lecane.*

Type material of this species has been deposited in the collection of the American Museum of Natural History. Cat. No. 870.

ORDER MONOGONONTA

FAMILY BRACHIONIDAE

Lepadella canadaensis new species

The shape of the lorica is broadly ovate. The dorsal plate is moderately convex and has a

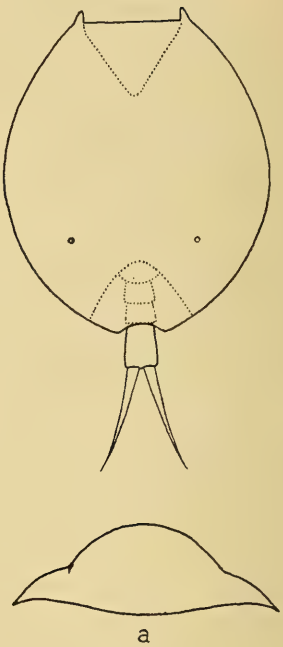

FIG. 2. *Lepadella canadaensis,* dorsal view; a, cross section.

wide inconspicuous, longitudinal median ridge; posteriorly there is a distinct emargination over the foot groove. There is no dorsal sinus, the anterior margin of the dorsal plate being perfectly straight. The ventral sinus is widely V-shaped. No stippled collar was observed. The foot groove is short, bluntly pointed anteriorly and has widely divergent lateral edges. The foot is composed of the usual three joints, the terminal being equal to the combined length of the first and second. The toes are long and slender; they taper gradually to very fine tips.

Length: lorica 74; terminal foot joint 9; toes 28. Depth: ventral anterior sinus 18; foot groove 15. Width: anterior points 26; lorica 60; foot groove 20. (Measurements in micro-millimeters).

Lepadella canadaensis was quite rare, only a few specimens having been found. It belongs to the *Metopidia* group of the *Lepadellid* rotifers, in which the dorsum, instead of being evenly rounded is triradiate in various degrees of development. It is closely related to *L. longiseta* Myers, from which it differs by the presence of a median dorsal ridge, instead of being evenly rounded; by the presence of a triangular shaped foot groove, instead of being oval; and, by the absence of prominent tubules from which the lateral antennae emerge.

Type material of this species has been deposited in the collection of The American Museum of Natural History. Cat. No. 871.

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THE BEAVER OF THE RIDING MOUNTAIN, MANITOBA

AN ECOLOGICAL STUDY AND COMMENTARY

By H. U. GREEN

(*Concluded from page 67*)

BREEDING — GESTATION — YOUNG — MIGRATION

From my observations I would say that male beavers are unquestionably monogamous. The presence of only one adult pair to a pond, the absence of intruders, and my tentative contention that breeding occurs during the early part of winter when both sexes are imprisoned beneath the ice, precludes the possibility of polygamy or promiscuity and likewise protects the female from the advances of other males who might seek her favours if the opportunity to do so were favourable. Whether monogamy on the part of the male is natural rather than adopted through force of circumstances, would be difficult to determine, but from a knowledge of male mammals there seems little doubt that if another adult female happened to be present she would have no cause to feel neglected, provided the attached female was not adverse to her presence.

In any event, I do not think that one mate throughout life is the rule, for upon the death of either sex of a pair it would seem that the survivor seeks or is not adverse to taking another companion. The beaver is too gregarious to lead a single existence. That bereaved beavers will take another mate was proved in July, 1931, when I introduced an adult female received from James Smart, Superintendent, Riding Mountain National Park, to an unattached male living at Site No. 2 whose female, I had reason to believe, died from wounds inflicted in an encounter with otters in the previous winter. The male, in this instance, remained in the pond in solitude. He was thus in no apparent hurry to mate again, nevertheless it is doubtful if he would have indefinitely continued a lone existence in the pond. When dumped from the large can in which she arrived by truck the introduced female immediately swam in the direction of the lodge and dived. The same evening I observed the pair together, evidently the best of friends. The pair disappeared from the pond in July, 1932, together with three kittens. What happened to them, I cannot say.

There is some suggestion locally that beavers breed in the late summer or autumn, and that copulation takes place in the water. However, as the young are born during the last week of May and the first week of June, breeding in the late summer or autumn infers a gestation period of about 7 or 8 months which, biologically, is of improbable duration for any rodent, irrespective of size.

I spent many hours watching the adult occupants of the ponds under observation when they were swimming about together during the late summer and autumn and interpreting noises heard within the lodge, but I cannot say that any amorous activity was evident or any sounds uttered which would suggest sexual interest. If, however, beavers breed during the winter, copulation would take place inside the lodge.

Several attempts were made to count the "kittens", at the ponds under observation, shortly after birth. Usually they all escaped as soon as one's hand was introduced through a small hole cut through the walls of the lodge into the "room". Sometimes I was successful in catching one. Even then in the scuffle that ensued there was some danger of injuring the captive. The following estimate of the number of young born from year to year in the lodges under observation was the maximum seen at any time together in the water of the ponds. As the counts are the result of several observations, I feel certain they are correct.

	1930	1931	1932	1933	1934
Site No. 1....	5	4	5	–	3
Site No. 2....	4	5*	3	–	5
Site No. 3....	6	3	4	4	5

*Embryos from dead female.

Just before the female gives birth to her "kittens" the male, who heretofore has occupied the same lodge with her, leaves the vicinity for several weeks. Should he return before the usual time he never approaches the lodge occupied by the female and "kittens", although he may be seen swimming near her when she is taking exercise or abroad to gather food. It has been noted that sometimes the female prefers to vacate the lodge occupied by the family during the winter, taking up residence in the spare habitation until the "kittens" are able to fend for themselves.

From my observations I would say that the "kittens" do not voluntarily leave the lodge in which they were born until they are about four weeks old, and even then it is doubtful if they are able to dive and gain the submerged entrance to return. Blindness, for a period after birth, is not the reason. Baby beavers are, without doubt, born with their eyes open.

On several occasions I have observed what I believe to be a female swimming with a "kitten" either in her mouth or clasped in her "arms" and dive with it when nearing the lodge, which might suggest that the "kittens" are driven out for exercise and to learn a thing or two about the life they are fitted for. The following experience adds weight to these observations and strongly infers that beavers also carry their "kittens" from place to place.

In the spring of 1931, Grey Owl and I visited Site No. 1 for the purpose of capturing two "kittens" to augment his tame family living in a small pond near Clear Lake, Riding Mountain National Park. An endeavour to catch them within the "island" lodge, where they were born, failed. We did, however, succeed in driving them into the water when it was expected they would float to the surface and, unable to dive, could be scooped up with a net carried for the purpose. But they did not all appear. Presently we heard a "kitten" crying in the shallow water oposite the lodge, which we caught without difficulty and placed in a box. A second visit to the lodge, about an hour later, showed that the remaining "kittens" were again inside. The following morning they were in the "bank" lodge, a hundred yards away. In what manner did they return to the "island" lodge after being driven out? How did they manage to traverse one hundred yards of water when they were too young to swim? The only logical answer seems to be that they were carried by one or other of their parents. Perhaps both assisted.

The captured "kitten" was exactly 11" long, an exact replica of its parents, and half as big again as the other little fellows I have taken from the lodges when attempting to count them. I was particularly impressed with its lack of fear and desire for human company. When we returned to camp it was taken from the box and placed on the grass. It immediately started to wander away, but at the sound of our voices waddled back to where we sat. I picked it up and placed it in the bosom of my shirt and it nestled down comfortably, as if gaining solace from the warmth and contact of an alien skin. I particularly mention these facts, for during many years in the wilderness I have mothered a host of orphaned creatures, but this little beaver was my first experience of an animal tame and chummy almost from the moment of capture. It demonstrates, I think, what may be accomplished with beavers when taken in infancy by one who is sympathetically inclined and endowed with a measure of patience to raise them by hand.

To what extent, if any, baby beavers assist their parents during the autumn following their birth, I am unable to say. When swimming about the ponds they were never observed to do anything useful, and the evidence of beaver-cut aspens and willows gave no hint of juvenile employment. I collected several nubbins of aspen poplar wood from 6" to 8" in length bearing the marks of baby teeth at each severed end from which splinters had been pried. These little sections would serve no useful purpose other than a medium to wear down the crowns of growing incisors and exercise the jaw muscles. Perhaps, though, gnawing wood is only a playful gesture indicative of more serious work to come.

Beaver "kittens", from what I have seen of them, apaprently have few diversions other than half-hearted attempts to chase one another in the water, although from what one can hear going on within the lodges there is evidence that sometimes they engage in friendly rough and tumble combat. That they squabble seriously when nursing is a matter of record, but can one expect otherwise should there be more youngsters than their mother has teats?

The "kittens" spend the first winter of life in the same lodge as their parents, but as soon as the ponds are clear of ice and the creeks fill with freshets of melted snow they forsake the place of their birth, never to return. The fact that a spare lodge and dens in the banks are available, or even a separate pond, as at Site

No. 2, is not considered sufficient incentive to remain. Just before their mother gives birth to her next litter of "kittens" it seems instinctive for them to leave the old home. At this time, as yearlings, they are about half grown.

One may readily trace these little migrants throughout the year as they follow the valleys in twos and threes, staying for awhile about some deep pothole on the line of march but always forging onward seemingly in search of some suitable location for a temporary abode. When winter comes a den in the bank beside a deep water-filled hole provides shelter, and a food pile gathered and planted nearby affords a means of sustenance until spring returns and sends them wandering, as two-year-olds, in search of mates.

The dens in which these migrating youngsters winter differ from those described at the conclusion of the last chapter inasmuch as their entrance is below the surface of the water, and while the former would be uncomfortable shelters, open and exposed, the latter are admirably adapted for the purpose.

I have one record of two young beavers wintering in a deep pothole on Tepee Creek, a tributary of the Vermilion River, with an ample food pile stored beside the underwater entrance terminating in a small "room". It was abandoned as soon as the creek commenced to flow in the spring. Several other dens of this nature were located along the course of the Vermilion River, affording evidence of winter occupation in the past. In no instance could it be inferred that they were used for permanent residence.

The migration of yearling beavers from the ponds under observation, the last stronghold of the species in the Riding Mountain, is indeed worthy of consideration with a view to preventing them from wandering beyond the borders of the park, for my investigation proves that practically the entire annual increase eventually leave the reserved area, not because there is any instinctive desire on their part to do so, but rather because no suitable environment offers an inducement to remain. The result is that through lack of sufficient water they continue downstream from one pothole to another until the settlement is reached and they are either killed forthwith for their pelts or find some suitable spot for the creation of a pond where they reside until found and destroyed. I have on several occasions during the past few years observed two-year-old beavers swimming in the Vermilion River beside my home in Dauphin which, from my knowledge of local beaver distribution could be none other than individuals born in the ponds under observation. Numerous authentic reports have also been received regarding the presence of travelling beavers between Dauphin and where the Vermilion River leaves the boundary of the Riding Mountain National Park.

One cannot view this annual loss without alarm. I feel quite sure that it could be easily and economically prevented if steps were taken to fill the breaches of many old dams along the course of the Vermilion River and its tributaries, and so create a chain of ponds which would undoubtedly induce migrant yearlings to remain in the hills. Further, the creation of ponds would conserve the watershed of the semi-arid uplands and restore as a food supply for elk and smaller deer the once abundant hay meadows now unproductive for want of moisture. They would also furnish much needed watering places for game animals. Should the experiment be tried and prove successful (which I have every reason to believe it would) there is no reason whatever why the Vermilion River valley and its tributaries within the Riding Mountain should not again support a generous beaver population.

TRACKS — SIGNS — FAECES

Although beavers may be actually employed about a pond, it is seldom one sees well defined tracks of all four feet. Generally speaking it is only in deep soft mud that impressions are left, and even then the record is usually no more than the digit marks of the fore feet. The webbed hind feet give little indication of their presence, but should tracks be left they are merely small depressions where the toe points sank in. These deficiencies are probably caused by the dragging tail moving slightly from side to side as the beaver waddles along which would have a tendency to obliterate all but the deep impressions. The records, however, are quite characteristic when once identified, and unlikely to be confused with the tracks of any other animal. On dry ground, not a mark can be seen, a fact that equally applied to wet padded places. In snow a wide furrow is left, slightly wider than the broadest part of the tail and with little or no indication of foot marks.

In general, signs of beaver habitation are too obvious to be deemed worthy of inclusion in any list. The pond, the dam, the lodge, are sufficient evidence when considered in conjunction with recent beaver activities thereabouts to prove that a site is occupied. Deserted ponds likewise indicate from their surroundings that no beav-

ers are about, for although the dam may be unbroken and the lodge intact there is an atmosphere of emptiness suggestive of vacancy best described as being like untenanted and neglected human habitations and premises.

Beaver signs remote from ponds, although some have already been mentioned alsewhere, are worthy of enumeration. They may be described as follows:

(1) Characteristic track signs and tail marks.
(2) Sign heaps, or mud piles, built along the banks of streams.
(3) Cuttings, large and small, bearing the marks of beaver teeth.
(4) Dens with entrances high in the bank beside streams, in which may be found peeled sticks and other vegetable debris suggestive of beaver occupation.
(5) Dens with entrances submerged or at water level in deep potholes where migrating beaver have wintered.
(6) Peeled aspen poplar and willow sticks swept over the crest of a dam by spring freshets and carried down stream, offering evidence of a beaver location above.
(7) Stagnant water flowing down stream during the summer months, indicating that a beaver pond is not far distant.

No mention has been made of beaver excrement as a distant sign, for the reason that excrement suggestive of the animal was never encountered away from the ponds. It is quite apparent that while beavers urinate on land, they defaecate only in water. I have on many occasions observed faeces floating on the surface of the ponds which I believed to be of beaver origin rather than that of any other animal inhabiting the water or its vicinity. Water soaked though it was, it gave little indication of its original form or substance. Undigested parts of light vegetation and minute particles of wood fibre were present in the specimens examined, indicative of beaver food. The extent and weight of the floating masses preclude their deposition by muskrats, and I feel quite certain that they may be accepted as a typical beaver sign wherever found.

No evidence of the presence of faeces was ever noticed inside a beaver lodge.

PARASITES — CLEANLINESS — DISEASE

I have no information to offer regarding parasitic infestations. The dead beavers examined and dissected were free from both external and internal forms. Any external parasites that could have been on the bodies may have departed, for the carcasses were long since cold when found or received. If the beavers in life harbour external forms (it would be remarkable if they did not) I think they would be few in number, due to the fact that they are extremely cleanly animals, devoting a great deal of time to their toilet. I have on numerous occasions observed individuals sitting on their tails diligently combing their fur with long bold strokes of "hands" and hind feet and enjoying themselves immensely. It is very noticeable during the process that the "hands" are frequently wiped over the anal region, and I am inclined to believe it is for the purpose of smearing them with oil and that the pressure exerted by the root of the bent-under tail assists to bring the substance from the glands. Apart from their value as "combs" the supernumary nails of the hind feet, it would seem, may assist in the removal of any unwelcome hosts the beavers may support. There is no doubt considering the force applied by the hind feet during the cleaning process that but few parasites could exist with any certainty.

No parasites were observed in the fur of the "kittens" examined but, as the search was somewhat superficial, I would hesitate to say that none were present.

The lodges afford a habitation for several species of small beetles, but as they were observed in both occupied and unoccupied structures, I do not think that there is any direct connection between them and the beaver occupants.

It is very doubtful if the beaver of the Riding Mountain have ever been subject to contagious or infectious diseases of sufficient virulence or intensity to cause any marked decrease in the former population. The isolation of individual families and the general lack of contact between them would tend to localize any outbreak that may have occurred. I am of the opinion that had disease decimated the population within the past 50 years their remains, or part of them, would have been found within the many old lodges examined.

ENEMIES — METHODS OF POACHING

The worst enemy the beaver of the Riding Mountain has to contend with is Man, ever alert to take advantage of favourable circumstances to invade their range and steal what pelts his cunning can secure. In the past the Canada Lynx, (*Lynx canadensis*) Bob-cat, (*Lynx rufus*) Fisher, (*Martes pennanti*) and Brush Wolf, (*Canis latrans*) undoubtedly took occasional toll on land, and the Otter (*Lutra canadensis*) may have engaged the beavers in mortal combat when invading the ponds in search of food. The

Adult beaver permanently confined in cramped and unnatural surroundings within earshot of running water and rustling poplar leaves.

Photograph by Burt Gresham.

lynx and bob-cat are now extinct in the Riding Mountain; the fisher is virtually non-existent. Brush wolves, though, still abound in varying numbers ,and only three otters have been seen or reported for a number of years.

Only one presumed casualty from four-footed enemies was noted among the beavers under observation,—a female whose carcass was found on the banks of Site No. 2 on June 19th, 1931, previously mentioned as dying from the result of wounds alleged to have been inflicted by otters who invaded the pond in the previous winter. That beaver fear the otter was evident from the conduct of the occupants of Site No. 1 when, in July, 1931, three individuals sojourned thereabouts and kept the beaver family together in the bank lodge until the unwelcome invaders departed elsewhere.*

I have never observed evidence of even an attempt by four-footed predators to enter a beaver lodge at any season of the year, although I have seen tracks of the brush wolf on the snow-covered slopes of the lodges during the winter months. The otters who visited Site No. 1, in July, 1931, were about the slopes of the "bank" lodge as shown by the presence of otter excrement. However, as previously suggested, it would be difficult for any animal to capture the inmates by digging through the walls of the lodge, for quite naturally they would leave at the first hint of invasion. Otters, though, could easily gain an entrance by way of the submerged tunnels, but even then the beavers would be able to leave the lodge by another exit, unless prevented by several otters seeking admittance together by different routes. The local belief that the much maligned black bear breaks into beaver lodges and kills the inmates may therefore, be discountenanced without discussion. It may nevertheless destroy an occasional beaver on land.

The otters referred to, should they revisit the ponds under observation and through increase add to their numbers, may become a problem to contend with.* "That the otter will molest beaver is, I think, proved by the obvious fear of the inmates of the lodge at Site No. 1 during the period the otters frequented their pond. That they will kill them may be thoughtfully inferred from the circumstantial evidence gathered from the examination of the beaver carcass found on the banks of Site No. 2. To support the latter belief, several of my Indian friends, including Grey Owl, have informed me on different occasions that two or

*Can. Field-Naturalist, Vol. XLVI, p. 206, Observations on the occurence of otter in the Riding Mountain National Park in relation to beaver life. By H. U. Green.

more otters will "gang" and kill an adult beaver in water if found alone. They tell me, too, that otters will kill and eater beaver "kittens" at every favourable opportunity" . . . . "While one hesitates to advocate the destruction of any fast-diminishing animal species, it would appear there is every reason to believe that the otter and the beaver inhabiting the restricted and sparsely watered terrain of the Riding Mountain, Manitoba, can not exist together if the remnant of beaver life is to remain unmolested. . . . ."

When the paper was written from which the above citations were taken, it was expected that the otters would return. Happily they have not done so, although there is no assurance they have departed from the district.

More serious than the possible future depredations of the otter is the annual toll taken by human design in spite of every effort of the authorities to prevent the loss. To my knowledge four families were wiped out within two years. How many other families and individuals hidden away in the forest met a similar fate, it would be difficult to say. There is no doubt whatever that once an isolated family is found its fate is sealed and a few more pelts find their way to unscrupulous dealers.

Beaver fur in the latitude of the Riding Mountain is at its best in the early spring, nevertheless one season is as good as another to local poachers. To overlook an opportunity to secure beaver pelts, is to be forestalled by another with similar intent.

There is much evidence to support the fact that in the past a favourite method of capture was to drain the ponds and either shoot or otherwise dispose of the unfortunate tenants, unable to escape. To the poacher, draining has one advantage, for he is able to secure an entire beaver family in a comparatively short time. To-day, shooting is the favoured method of destruction, and armed with a small-bore rifle the poacher awaits the appearance of the beavers on the surface of the pond during the daylight hours and can generally shoot the adults before darkness falls. Trapping, though, is not disdained. The trapper, however, takes greater risks to achieve his purpose. He is faced with two alternatives, and has either to make frequent visits to his sets or camp in the vicinity of the pond until his victims are captured. Consequently he takes more chances of being caught than the individual who makes a day of it and speedily departs.

By the poacher who prefers the steel trap, Size No. 4 is most commonly used, but Sizes No. 3, and even No. 2, are equally effective. The manner of setting varies with the season. For winter trapping a hole about 18" square is cut through the ice of the pond where the water beneath is not more than 2' deep. Stakes of dry wood are then driven into the mud a few inches apart in the form of a three sided enclosure. A section of green poplar or birch about 2" in diameter and 18" long is used for bait and fastened inside the pen close to the back near the bottom. The trap is set within the enclosure and fastened by a chain to a stake of dry wood. The beaver is attracted by the fresh bark of the bait which is particularly favoured in preference to the water-soaked stuff from the food pile. The custom during the open season of the year is to place the trap weighted or connected to a heavy sinker on a shelf cut in the bank of the pond about 4" below the surface. A sprig of green twigs or, if obtainable, a piece of beaver castor impaled upon a stick, is suspended above the trap, offering the necessary inducement for a beaver to approach the set and unwittingly place the weight of a limb on the pan.

Variations of the trapping methods described are numerous and equally barbarous, for a trapped beaver seldom drowns in shallow water, and so lingers in agony while awaiting the blow that will end its misery. The popular belief that beavers sometimes escape from a trap by gnawing off the limb which holds them captive, is untrue. Some escape leaving behind a foot as a momento of their agony, twisted off in their frantic struggles to free themselves. In any event the degree of suffering is the same. With the memory of many carcass-strewn traplines and the inhuman and unscientific means employed by the average trapper to dispatch what victims are still alive ever fresh in my mind, I have often wondered if the females of our race, who even in midsummer crave furry adornment, would hesitate to cloth themselves with forest fur if they realized the cruelty of the steel trap. If they did, the vital problem of conserving the beaver (and other fur-bearers on the verge of extinction) would be quickly solved.

Apart from the barbarity of steel trapping, reference to which, strictly speaking, may seem superflous to this study, the appliance is to be condemned on economic grounds. Regulations for trapping beavers have never considered the protection of the female as a measure of conservation either through ignorance or the failure to realize that a steel trap is no respector of

sex. The destruction of a breeding female is poor economy, but to destroy her a few weeks before parturition is infinitely worse. The killing of yearlings, too, still with their parents, is yet another instance of careless management, Worse still is the thought of the complete extermination of a beaver family by the average trapper, here to-day, gone to-morrow. There are many types of traps on the market capable of capturing beavers alive and unharmed. Would it not seem a reasonable suggestion to those who "direct" our wild life resources to at least experiment with these contrivances with a view to their adoption in the interest of protection and economy? These suggestions, of course, do not apply to the Riding Mountain National Park which is a federal sanctuary wherein every form of wild life is protected.

CONCLUSION

A study of the beaver of the Riding Mountain would be incomplete without a few constructive suggestions regarding management, especially as the field work accomplished is the first serious attempt to record comprehensively their life history and discuss the problems incidental to their welfare. It is possible, too, that the comment may be applicable elsewhere.

When a few beaver families are scattered far and wide over a wilderness area entirely surrounded by settlement, and often in localities unknown to, or infrequently visited by, wardens, the matter of protection is unquestionably difficult. Under such circumstances even the value of specialized effort would be set at nought. Therefore, the only solution to conserve and protect the beaver remnant that remains would seem to be the capture and segregation of isolated families in a selected area, preferably the valley of the Vermilion River, under the constant surveillance of some responsible person not only familiar with beavers, but also sympathetically interested in their conservation.

The suggestion to repair the many broken dams in the Vermilion River valley was previously mentioned as a means for inducing migrant yearlings to remain within the confines of sanctuary. The re-created ponds would also furnish ready-made habitats for transplanted families.

The matter of beaver transplantation, however, invites the question as to whether mated pairs removed from one environment to another would take kindly to the change of locality and remain contentedly in a new home. Several of my acquaintances with a knowledge of the beaver gained from the trap line intimate that beavers will not stay in a pond other than of their own creation. They are unable, though, to give any specific instances.

My experience, however, tends to offset the supposition that beavers fail to take kindly to a new environment, forcibly introduced. Late in June, 1933, I surprised two beavers, believed to be a mated pair about two years old, sporting in a shallow pothole on Tepee Creek, a tributary of the Vermilion River. The couple, undoubtedly born in one of the ponds under observation, were apparently travelling in search of a suitable place to make a pond and settle down in approved beaver fashion. Realizing that if they continued downstream, or even remained in the vicinity, it would only be a question of time before death at the hands of predacious humans would seal their fate, I decided to capture them with a view to repopulating the ponds at Site No. 2, vacant since the summer of the previous year. The transfer was accomplished in a few hours, and the beavers released in the upper pool. Upon revisiting Site No. 2 two weeks later, I was greeted with the resounding slap of a beaver tail and a splash of water. The lodge in the lower pond was built up and some cutting done in the aspens on the bank nearby. It seemed that the wanderers were grateful for a decent place in which to live. My protegés are still in the ponds at Site No. 2, a happy and contented pair with a family of five "kittens".

It must be admitted that this successful transplantation in nowise ensures that mated pairs already located would take kindly to another environment however generous it may be. This can only be determined by experiment. Nevertheless, there is no reason to believe that an equal measure of good fortune is improbable.

The value of a normal beaver population to the semi-arid area of the Riding Mountain about the Vermilion River district, can not be too strongly stressed. There is ample proof that fifty years ago it was better watered than it is to-day. The presence of beavers with their numerous ponds holding back the water of the creeks and creating many acres of marshy meadowland, not only made feeding and watering places for game mammals, but also provided a habitat for many species of waterfowl and countless other creatures of the forest. In those days water, and all it means, was retained.

The question of bringing back the beaver to the Riding Mountain, if for no other reason than its undeniable value as a conservator of water and creator of meadowland, is indeed worthy of serious consideration. The pressing

need at this time for additional ground feed for elk and smaller deer and the urgent necessity for more water on the game range about the height of land during the heat of summer days can well be provided by the activities of this little animal engineer. More beaver ponds will attract more waterfowl, marsh birds, and other feathered folk to enhance the value of sanctuary and delight the eye and heart of the nature lover seeking to profit by National Park ideals.

RUNNING SPEEDS OF SKUNK AND EUROPEAN HARE

By D. A. MacLULICH, B.Sc.F.

ACTUAL measurements of the running speeds of animals are seldom obtained, therefore it is thought worth while to place on record some that the writer has been fortunate enough to observe. By way of comparison it may be mentioned that Seton (1928) states that the White-tailed Jack Rabbit, *Lepus townsendii,* can travel at the rate of thirty miles an hour; the Black-tailed Jack, *Lepus californicus,* twenty-eight miles per hour, and the Varying Hare, *Lepus americanus,* at twenty-six miles an hour. Vorhies and Taylor (1933) record that "Speedometer tests show that probably both species of jack rabbits [*Lepus californicus* and *Lepus alleni*] readily attain speeds of thirty to thirty-five miles an hour. *Lepus alleni,* at least, is capable of higher speeds on rare occasions."

A European Hare, *Lepus europaeus,* was paced by the car on a narow gravel road in Innisfil township of Simcoe County, Ontario, on October 12, 1935, With the car about thirty-five feet behind it the hare ran in the glare of the head-lights for about two hundred yards at a speed varying between twenty and twenty-two miles an hour. It finally dodged sharply off at right angles into a field. The full moon gave bright illumination.

A second measurement was obtained near Beaverton in Ontario County, Ontario, at midnight on October 18, 1935. This European hare ran, apparently at full speed, alongside a front wheel of the car for a quarter of a mile at thirty miles an hour.

A Skunk, *Mephitis mephitis,* ran 150 yards along a narrow dirt road ahead of the automobile in the light of the head-lamps on September 21, 1933, by that part of Buckshot Lake which is within Abinger township in Lennox and Addington County, Ontario. It ran at a speed of about six miles an hour. Although it nosed off to the side of the road several times it did not leave it until it reached a clearing beyond an alder swamp. Presuming the animal would leave the track if the head-light glare were removed I switched the lights off for a few seconds but the beast continued to run down the road.

The next year, nearby, in the same township while I was pasing through a sugar maple forest a Skunk ran before the car for about one hundred yards. This was on September 19. Once the Skunk stopped and turned to leave the road but apparently could not see its way quickly enough so it resumed its flight. I turned off the lights and the Skunk immediately hurried from the road. Its speed was found to be between eight and nine miles an hour. Both this night and that of the previous episode were dark, so the car lights could have been dazzling.

LITERATURE CITED

SETON, ERNEST T., 1928, *Lives of Game Animals.* vol. 4, Garden City, N.Y.

VORHIES, CHAS. T. & TAYLOR, W. P., 1933, *The Life Histories and Ecology of Jack Rabbits,* Lepus alleni *and* Lepus californicus *ssp., in relation to grazing in Arizona.* Univ. Ariz., College Agri., Tech. Bull. No. 49.

NOTES AND OBSERVATIONS

THE AMERICAN CASPIAN TERN (*Hydroprogne caspia imperator*) AT OTTAWA. As I was standing just outside my house, at 34 Grosvenor Avenue, in the southern part of Ottawa, between the Rideau River and the Rideau Canal, about 1.30 p.m. (Daylight Saving Time) on May 9, 1935, I heard, almost directly overhead, the loud, harsh cry, "A-a-ark!", of the American Caspian Tern. I recognized it immediately, before I looked up. On looking up quickly, I saw the Caspian Tern, which I estimated to be about 300 feet above me. It was flying eastward, and

I had a good view of it for 20 or 30 seconds. Points recognized were (1) size, about that of a Ring-billed Gull, (2) white and pearl-gray coloration, (3) angular outline of wings, quite different from the curved front wing-edges of a flying Gull. A moment after I saw it, it uttered its characteristic cry a second time. It uttered the same cry at least twice more before it passed out of sight over the house-tops. I had no opportunity to observe the bird through binoculars.

In connection with this identification it is pertinent to state that I had visited a breeding colony of American Caspian Terns, at Fog Island, Saguenay County, Quebec, every summer for the twelve years immediately prior to 1935, and that I had thus become very familiar with the appearance and the voice of the species. I am wholly certain that the bird recorded above was a Caspian Tern.

The day of this observation was warm, with a strong southwest wind. It was partly cloudy, but the light was good when the observation was made.

There appears to be no previous record of a Caspian Tern in the Ottawa district.—HARRISON F. LEWIS.

THE ROSS GOOSE (*Chen rossi*) IN ALBERTA.—When driving through the country east of Bittern Lake on the afternoon of October 12th, 1935, I noted two white geese feeding in a grain field, in company with a large flock of Canada Geese. At the time I believed them to be Lesser Snow Geese, small numbers of which occasionally mix with the "honkers". On October 17th, Alex Burgess, a local hunter brought me a pair of very small white geese he had killed that morning as they rested on the sandy shore of Bittern Lake, about four miles south of where I had, a few days before, seen the white geese. These proved to be Ross Geese and were probably the ones I had seen on the 12th of the month. The absence of warty growths at the base of the bills would indicate they were birds of the year, probably less than four months old. Measurements of the male were: length, 22½ inches; extent, 45 inches; wing, 14½ inches; and bill, 2 inches. The female was slightly smaller. Legs and feet bluish and bill reddish. Weight of male 3¼ pounds, female 3 pounds. Mallards killed the same day weighed from three to three and a quarter pounds. The plumage of both birds had a decidedly rusty appearance, much like that comonly found on Lesser Snow Geese, a result of their frequenting iron-impregnated waters.

Wintering in California, the Ross Goose is believed to migrate, chiefly through Alberta, to and from its nesting grounds in the Arctic regions. There are, however, few records of its occurrence in this province, probably due to the fact that "wavies" are not popular, and are seldom killed by hunters. At rare intervals during the past 40 years I have heard of small white geese, no larger than a mallard, having been killed in Central Alberta, but those referred to above are the only ones I have ever seen. A more appropriate name for this diminutive "wavey" would seem to be the "Least Snow Goose."—FRANK L. FARLEY.

BOOK REVIEWS

Insect Enemies of Shade Trees, by Glenn W. Herrick. Comstock Publishing Co., Ithaca, New York, 1935. *pp.* 417, *illus.* 321, *indexes, numerous bibliographics.* $5.00.

Intended primarily for people interested, either professionally or as amateurs, in the preservation of shade trees, this book forms a complete manual. Methods of repairing injured trees, materials and apparatus for the control of insect and other pests, suggestions for the fertilization of the soil, are all discussed clearly and comprehensively. Valuable notes on the relative utility of shade trees and their susceptibility to pests are included. The American Elm heads the list for general utility, while the Ginkgo is first as far as freedom from insect pests is concerned, a fact which may account in part for the long life history of this interesting tree which is often referred to as a "living fossil" for it has existed unchanged for many millions of years and is now unknown in a wild state, being found in China and Japan in the vicinity of palaces, shrines and tombs where it is cultivated. This is a book which anyone interested in trees would do well to obtain.—D. L.

BIRDS OF THE EASTERN ARCTIC. *By P. A. Taverner, National Museum of Canada, Department of Mines. In "Canada's Eastern Arctic", assembled by W. C. Bethune for the Northwest Territories Council, Department of the Interior, Ottawa,* 1934.

This paper consists of an annotated list of the birds known to have occurred in the region with which it is concerned, prefaced by comment on the difficulties of ornithological work there and a résumé of such work in recent years. Ornithologists who are named as having been active in Canada's Eastern Arctic in the twentieth century are J. D. Soper, G. M. Sutton, Bernhard Hantzsch, R. M. Anderson, and the author himself.

The annotated list includes 116 species, most of which are definitely known to occur in the eastern part of the Canadian Arctic, though a number of those included have not yet been recorded there with certainty, but may possibly occur there. The species listed belong to twelve different orders, among which the Order Charadriiformes, with 46 species, is decidedly the best represented. The only other orders represented in the list by more than 10 species are the Anseriformes, with 24 species, and the Passeriformes, with 15 species.—H.F.L.

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VOL. L OTTAWA, CANADA, SEPTEMBER, 1936 No. 6

A PRELIMINARY LIST OF THE BIRDS OF LINCOLN AND WELLAND COUNTIES, ONTARIO

By R. W. SHEPPARD, W. E. HURLBURT and G. H. DICKSON

ALTHOUGH both Lincoln and Welland were among the first counties to be settled in old Ontario, and much has been written regarding their human histories, there would appear to be a remarkable absence of available literature dealing with the natural history of this region. This being the case, the writers are of the opinion that some of the ornithology of these two border counties, presented in the form of a preliminary and annoted list, would be not unacceptable at the present time.

The observations, although covering, more or less, the entire area of the counties under discussion, have been carried out chiefly within the vicinities of Vineland in Lincoln County and Niagara Falls in Welland County and have, in general, been made within the past ten or twelve years; in one or two instances, a few older records have been incorporated.

Roughly, the combined counties of Lincoln and Welland form the more easterly half of the Niagara Peninsula. They are bounded on the north by Lake Ontario; on the east by the Niagara River; on the south by Lake Erie and the somewhat rough, wild country of the old Indian Line, and on the west by the mixed farming lands of Wentworth and Haldimand Counties.

The entire area is drained by the Welland River and by several small creeks which run into Lake Ontario and the Niagara River.

Welland County is largely given over to mixed farming with here and there considerable acreages of land still covered with hardwood trees, forming patches of a type of environment common in southern Ontario.

The highest elevation in the county occurs at Ridgeville, in Pelham township, where the hills reach a height of about 825 feet; whereas the rest of the county averages only about 575 to 600, or a few feet higher than the high-water level of Lake Erie.

In the southern part of the county, there are still one or two fairly extensive marsh or peat bog areas which, however, are gradually being drained and so are diminishing in size as time goes on.

The Lake Erie shore line is largely composed of fine sandy beaches or hardened, rock-like, mud flats, backed by low sand hills which are covered by natural growth, or reafforested with pine and poplar, and much given over to summer home colonies.

The Welland county boundary, on the east, extends the entire length of the upper Niagara River and along the greater part of the deep gorge between Niagara Falls and Queenston Heights, and, without a great deal of interference with natural conditions, has been planted and otherwise developed along its entire length by the Niagara Falls Park Commission.

The county of Lincoln is divided into two sharply defined areas; that which is situated below the escarpment and is largely devoted to the growing of soft and tender fruits, and that which is above the escarpment and varies little in character from the mixed farming and wooded lands of Welland County.

The low-lying sections of the county, which are bounded on the north by Lake Ontario and on the east by the lower Niagara River, average between 275 and 325 feet in elevation, or, roughly, 25 to 50 feet above the high-water level of the lake, while the higher ground approximates the average elevation given for the County of Welland.

The escarpment, or mountain, as it is locally called, is a wooded slope or ridge, some 200 to 300 feet in height, which extends the entire length of Lincoln County. The woods vary somewhat in density and in character; those at the extreme eastern end of the ridge being of a somewhat open nature, with the Red Juniper (*Juniper virginianus*) and the White Cedar

(*Thuja occidentalis*) predominating; while, toward the west, there are many patches, or considerable areas, of dense, tangled deciduous growths, this condition being especially accentuated along the steep slopes of one or two streams or creeks which intersect the ridge in the vicinity of Jordan.

The greater part of the Lake Ontario shoreline consists of narrow, pebbly beaches backed by low crumbling cliffs of clay or sand; but in one or two spots, such as Niagara-on-the-Lake, there are some fairly extensive sandy beaches; while in other places, notably at Jordan Harbour, the creeks flowing into the lake have widened out at their mouths into large shallow ponds or marsh-like areas.

The entire district, although presenting certain interesting physical features, is, nevertheless, perhaps more interesting from a zoö-geographical point of view, for here, somewhere within or close to the Niagara Peninsula, is the probable meeting place of the Upper Austral and Transition life zones.

In compiling this list the nomenclature of the A.O.U. Check-list (1931) has been rigidly adhered to throughout. For many of the older references and for much helpful criticism and advice, the thanks of the authors are due to James L. Baillie, Jr., of the Royal Ontario Museum, to P. A. Taverner of the National Museum, of Canada, and to Dr. Harrison F. Lewis of the Department of the Interior.

Gavia immer immer (Brünnich). COMMON LOON. — The Loon or Great Northern Diver is not at all an uncommon bird in the upper Niagara River during both migration seasons and, at these times, is also occasionally to be seen in the wide expanse of river immediately below the two falls.

Gavia stellata (Pontoppidan). RED-THROATED LOON. — This Diver has been reported from the Niagara River on several occasions by members of the Buffalo Ornithological Society; but we have no personal observations to report and no definite information regarding its occurrence in what might be termed strictly Canadian waters.

Colymbus grisegena holboelli (Reinhardt). HOLBOELL'S GREBE. — We have only one personal record of this species, a lone individual which was observed by the senior author at Niagara Falls in the autumn of 1926. There is an earlier record given by Blain[1] of an adult male which was picked up on the Canadian side of the river, opposite the American Falls, on September 29, 1903.

1. *Auk*, 21: 276, 1904.

Colymbus auritus Linnaeus. HORNED GREBE. — The Horned Grebe is frequently seen, during the spring and autumn migration seasons, in the wide expanse of water below the Horseshoe and American Falls. It is especially noticeable in the late autumn, at which time individuals or small scattered parties can be seen almost any day, keeping close in shore, around the bays and back-waters of this section of the lower river. H. M. Laing[2] writes of seeing hundreds in Lake Ontario, near Beamsville, in Lincoln County, during October, 1918.

Podilymbus podiceps podiceps (Linnaeus). PIED-BILLED GREBE. — This Grebe cannot be considered a common bird within the territory under discussion; but it is known to occur fairly regularly in the vicinity of Jordan and Vineland, during the migration seasons.

Pelecanus erythrorhynchos Gmelin. WHITE PELICAN. — We are in some doubt as to whether we should include this species in our list, for the only known record for the vicinity belongs more properly to Erie County, N.Y., than to Welland County, Ontario. James Savage[3] has given an account of a White Pelican shot near the International Bridge, Niagara River, on October 5th, 1894, and from this account it would seem highly probable that the bird in question was over Canadian waters shortly before it was shot on the New York side of the river.

Moris bassana (Linnaeus). GANNET. — H. D. Mitchell[4] reports an immature bird of this species observed on the Niagara River near the Peace Bridge, on October 29, 1933, and in his notes mentions a previous record for this general region (apparently referring to J. H. Fleming's *Ontario Bird Notes*[5]) of a specimen taken at Wainfleet, Welland County, in November, 1907.

Phalacrocorax auritus auritus (Lesson). DOUBLE-CRESTED CORMORANT. — Apparently a rare visitor to the Niagara district, for we have only three personal records of this species; a single bird having been seen on the 11th of May, 1924, and watched for a considerable time as it rested on some rocks in the river between the Maid of the Mist landing and the Horseshoe Falls, and two others, apparently immature birds, seen in exactly the same place, one on October 2nd, 1932, and the other on October 29th, 1933. We have a report of one other record for this district, that of a dead one pick-

2. *Can. Field-Nat.* 34: 21, 1920.
3. *Auk*, 12: 313, 1895.
4. *Auk*, 51: 392, 1934.
5. *Auk*. 25: 486, 1908.

ed up by George Dickson, Jr., on the lake shore near Vineland, on the 23rd of October, 1931, and later sent to the Royal Ontario Museum for preservation. Laing[6] records seeing a lone Cormorant, which he took to be of this species, at Beamsville, in November, 1918.

Ardea herodias herodias Linnaeus. GREAT BLUE HERON. — The Great Blue Heron is quite frequently observed during the summer months along the Niagara River, the Welland River, and the feeder canals in Welland County. It is also of common occurrence within the County of Lincoln and, near the southern boundaries of that county, in the vicinity of Caistorville, near the Old Indian Line, there is a large heronry situated in the midst of an immense area of wild, swampy, wooded land. This colony was visited several times during 1931 and 1932 and as many as 45 nests were counted; nearly all of them being built in tall elm trees. We have reason to believe that herons (locally reported as cranes) nest on Navy Island in the Niagara River, but it is probable that most of the Herons seen along the river bank come from the very large heronry on Grand Island, N.Y., which has been so interestingly reported upon by A. R. Shadle[7].

Casmerodius albus egretta (Gmelin). AMERICAN EGRET. — Two were closely observed on August 8th, 1933, as they fed in reedy shallows along the Niagara River bank about 15 miles down the river from Fort Erie. One bird remained in the vicinity until August 18th and afforded many excellent opportunities for observation. There was, apparently, quite an extensive influx of Egrets into southern Ontario during the summer of 1933, for several reports were received of these large white birds being seen in different parts of the district. W. E. Hurlburt[8] reports an American Egret observed in the Wainfleet marshes of Welland County on August 15, 1928. In addition to these sight records, it may be of interest to mention here that there is a mounted specimen of this Egret in the Vineland Station school, with no information except the donor's name, N. P. Moyer.

Butorides virescens virescens (Linnaeus). EASTERN GREEN HERON. — This small heron is not uncommon in Welland County and has been met with a number of times within the vicinity of the Niagara River. The junction of Lyon's Creek and the Welland River was at one time a favoured haunt of this species; while, in recent years, they have been found during the breeding season at Dufferin Islands, a semi-artificial backwater of the Niagara River about one mile above the Horseshoe Falls. This species does not appear to be so commonly met with in Lincoln County; but we have at least two definite records from Culp's reservoir, near Vineland.

Nycticorax nycticorax hoactli (Gmelin). BLACK-CROWNED NIGHT HERON. — Of late years this bird has been observed on a number of occasions feeding, after sunset, in the shallows along the Niagara River bank between Niagara Falls and Fort Erie. Shadle[9] writes of counting over a hundred nests which he believed to belong to this species in the Grand Island heronry; but, curiously enough, the Night Herons which we have observed on the Canadian shore have, on more than one occasion, been seen flying toward the river from some inland point, in Welland County, a circumstance which would tend to indicate that the island heronry is not the only nesting area in this vicinity. Laing[10] observed two Night Herons, in August, 1918, at Beamsville, in Lincoln County, while a number of more recent observations have been made at other points along the Lake Ontario shore line of that county.

Botaurus lentiginosus (Montagu). AMERICAN BITTERN. — A reasonably common bird among the reed beds along the banks of the upper Niagara River. Also, it has been met with along the banks of Lyon's Creek and the Welland River, near Chippawa, as well as in various other parts of Welland County. Within the County of Lincoln, this species is quite common around the Jordan ponds and is occasionally met with elsewhere within the county limits.

Ixobrychus exilis exilis (Gmelin). EASTERN LEAST BITTERN. — A bird of this species, apparently moulting, for its wings were very bare of feathers, was caught alive in the Jordan Marshes, Lincoln County, on September 2, 1935.

Cygnus columbianus. (Ord). WHISTLING SWAN. — Nearly every spring, considerable numbers of Swans appear on the Niagara River and in some seasons more or less serious mortality occurs, due, apparently, to the sleeping or resting birds, drifting down the upper river, being caught in the swirling rapids and dashed over the Horseshoe Falls. In general, we are inclined to believe that many reports of the mortality of Swans at Niagara have been grossly exaggerated, for actually only a very small proportion of the migrating Swans, which appear

6. *Can. Field-Nat.* 34: 21, 1920.
7. *Auk*, 48: 567, 1931.
8. *Can. Field-Nat.* 42: 210, 1928.
9. *Auk*, 48: 567, 1931.
10. *Can. Field-Nat.* 34: 22, 1920.

almost annually in the vicinity of the Falls, meet with either death or injury. Perhaps the most serious Swan catastrophe, within recent years, occurred during the night of March 24th to 25th, 1928, when several hundred Swans were apparently swept over the Horseshoe Falls; but even on this occasion the numbers of live and apparently uninjured birds, which were found congregated, on the morning of the 25th, in the river below the Falls, undoubtedly exceeded by five to one the numbers of those found dead or maimed. On this particular day, by actual count, two hundred and twenty Swans, apparently quite capable of continuing their migration, were observed in the wide expanse of river immediately below the American and Horseshoe Falls; while many others were noted flying up and down the lower river, within the gorge, as though seeking those killed or injured companions which had been carried down through the whirlpool rapids. Apparently Niagara has taken its toll of Swans periodically over a number of years, and various accounts of former catastrophes have been given from time to time. The most important of these accounts is to be found in an article entitled "The Niagara Swan Trap" which was published in 1912 by J. H. Fleming[11]. Apart from the large numbers seen in the vicinity of Niagara Falls, records of Swans in other parts of the territory under discussion are comparatively scarce; however, two individuals were observed on Lake Ontario, near Vineland, on April 1st, 1928, and one solitary bird, possibly slightly injured, stayed on the Jordan ponds and was fed by the local residents for two weeks or more during the latter part of April, in that same year. Within the past few years, we have one late autumn and many early spring records of Swans on the Niagara River, and several reports, or observations, from the Port Colborne area of Welland County, and the Jordan district of Lincoln County.

Branta canadensis canadensis (Linnaeus). COMMON CANADA GOOSE. — Frequently observed in Welland County. First noticed, at Niagara Falls, as a passing migrant in the spring of 1920, when a flock of twenty-two were seen, on April 1st, flying in a northeasterly direction. One year, two Canada Geese were observed passing over Montrose, in an easterly direction, as early as March 9th; while in 1932, a flock, containing a hundred or more individuals, was seen, on March 26th, flying north over Stamford township and making a tremendous noise as it went. Smaller numbers of these birds have occasionally been seen resting on the waters of the upper Niagara River.

Chen hyperborea hyperborea (Pallas). LESSER SNOW GOOSE. — A comparatively small number of Snow Geese, doubtless all referable to the Lesser Snow Goose, accompanied the immense flocks of Blue Geese which appeared in this area during the period October 26 to 31, 1935. According to James Savage, who is quoted by Clarence Cottam [12] in his interesting article on *Blue and Snow Geese in United States*, a Snow Goose was shot on the Canadian side of the Niagara River near Fort Erie on November 1st, 1934.

Chen caerulescens (Linnaeus). BLUE GOOSE. — Great flocks of Blue Geese, variously estimated to contain from 5,000 to 10,000 birds, visited the Niagara River and the Lincoln County shore line of Lake Ontario during the last few days of October, 1935. On the night of October 27th many were swept to their death over Niagara Falls and from among these casualties several specimens of both adult and immature birds were secured for preservation in the Royal Ontario Museum at Toronto, and the National Museum of Canada in Ottawa. There would appear to be no previous record of the occurrence of this species at the eastern end of the Niagara Peninsula.

Anas platyrhynchos platyrhynchos Linnaeus. COMMON MALLARD. — This cosmopolitan species is not uncommon on the upper river during autumn, winter, and early spring and at that time individuals or small parties can almost always be seen frequenting the shallows above Goat Island, N.Y. The deeper waters on the Canadian side of Niagara River are not much favoured by this duck; although, at times, it makes an appearance in the vicinity of what used to be the mouth of the Welland River, near Chippawa.

Anas rubripes tristis Brewster. COMMON BLACK DUCK. — Associating, more or less, with the preceding species and vastly outnumbering it, the Black Duck is a regular winter visitor to the shallows above Goat Island, N.Y. Sometimes, at this point, in mid-winter, this species can be seen, in large numbers, resting on the ice far out in the river. This species does not appear to favour the Canadian side of the river to any great extent, but odd individuals or small parties have occasionally been observed near the Canadian shore, both above and below the Falls. Although our observations on the Black Duck have

11. *Auk*, 29: 445-8, 1912.

12. *Auk*, 52: 435, 1935.

been placed under the title of Common Black Duck, it is almost certain that both sub-species occur and that many of the overwintering birds at Niagara should be referred to as the Red-legged Black Duck *A. rubripes rubripes*.

Chaulelasmus streperus (Linnaeus). GADWALL. — This somewhat rare duck has been reported by the Buffalo Ornithological Society on several occasions from the shallow waters around Goat Island at Niagara Falls, N.Y., and although it probably occurs on the Ontario side there would appear to be some uncertainty regarding its status in adjacent Canadian waters.

Mareca penelope (Linnaeus). EUROPEAN WIDGEON. — No personal observations to record, but James Savage of Buffalo has informed us of a bird of this species seen near Port Colborne on March 26, 1935, while others have been reported as occurring in Lake Erie, off the Welland County shore, by members of the Buffalo Ornithological Society.

Mareca americana (Gmelin). BALDPATE. — We have no personal observations to record on this duck, but it has been reported in some numbers off the Welland County shore of Lake Erie by the Buffalo Ornithological Society in their mimeographed journal, *The Prothonotary*, while Laing[13] in his account of Lake Shore Bird Migration at Beamsville records this species, on September 26th, 1918, under a question mark.

Dafila acuta tzitzihoa (Vieillot). AMERICAN PINTAIL. — Apparently of not very common occurrence within the area. The senior author saw a pair of these beautiful ducks on the sandy beach at Niagara-on-the-Lake on May 1, 1935, and this species has been reported by the Buffalo Ornithological Society, in their "Spring Duck Census", as occurring along the Welland County shore line of Lake Erie. There is a mounted specimen in the possession of Mrs. Emerson Culp, of Vineland, which we understand was shot by the late Mr. Culp on his farm, about two miles south of the village. Laing[14] at Beamsville, in 1918, saw 3 on September 30th, a flock on October 18th, and 1 on November 12th.

Nettion carolinense (Gmelin). GREEN-WINGED TEAL. — This small duck has been reported on a number of occasions from the Niagara River but an apparent absence of definite records from the Ontario side leaves us in some doubt as to its status within the limits of our territory.

Spatula clypeata (Linnaeus). SHOVELLER. — No recent, or personal records. Two were observed by Laing[15] at Beamsville on September 19th, 1918.

Aix sponsa (Linnaeus). WOOD DUCK. — An observation of this duck in the swampy woodlands near Warner in Lincoln County has been reported by the Buffalo Ornithological Society in their journal *The Prothonotary* for June, 1935. About midsummer, 1934, a glimpse of a duck, believed to be referable to this species, was obtained by the senior author as it flew up from the surface of a small pool by the side of a patch of woodland near St. Davids in Lincoln County.

Nyroca americana (Eyton). REDHEAD. — Apparently a rare visitor to the Niagara district for we have only two personal records of this species; a fine adult male having been seen on the river, below the Falls, on February 7th, 1925, and another one, in the same place, on November 12th, 1933. Recorded from the Welland County shore line of Lake Erie by the Buffalo Ornithological Society, in their "Spring Duck Census" of 1935.

Nyroca collaris (Donovan). RING-NECKED DUCK. — This duck has been recently reported by the Buffalo Ornithological Society as occurring in April on Lake Erie off the Welland County shore, and there is an old record by Eaton [16] of a Ring-necked Duck near Niagara Falls in February, 1899.

Nyroca valisineria (Wilson). CANVAS-BACK. — The Canvas-back is not an uncommon duck on the Niagara River in winter and during the early part of the spring and at this time it is apt to appear, either above or below the Falls, in small parties of half a dozen or more individuals. There is a mounted specimen of this duck, in the possession of Mr. N. H. Culp, of Vineland Station, which was picked up injured at the Falls, on March 26, 1928.

Nyroca marila (Linnaeus). GREATER SCAUP DUCK. — Odd individuals, pairs, or small parties of this duck appear occasionally, during very late autumn or early winter, in the river immediately below Niagara Falls. At one time we were under the impression that this was a reasonably common duck at Niagara, but recent very careful observations have tended to indicate that many of our earlier records should have been referred to the next species.

Nyroca affinis (Eyton). LESSER SCAUP DUCK. — Although long in doubt, we are now quite

13. *Can. Field-Nat.* 34: 22, 1920.
14. *Can. Field-Nat.* 34: 22, 1920.
15. *Can. Field-Nat.* 34: 22, 1920.
16. *Birds N.Y.* 1: 208, 1910.

sure that this is much the commoner of the two Scaups occuring on the Niagara River. Early in the autumn, this species appears to be the only one present, but in late autumn, or early winter, the two species are not infrequently seen together, the smaller bird, almost invariably, outnumbering the larger.

Glaucionetta clangula americana (Bonaparte). AMERICAN GOLDEN-EYE.—The commonest winter duck on the Niagara River. Sometimes, during mid-winter, hundreds can be counted on the river between Niagara Falls and Fort Erie. This bird is frequently to be seen in the strong currents and rapids above the Falls and its swimming and diving powers must be remarkable, for on two occasions during the month of January, 1926, a dozen or more individuals of this species, most females, were observed diving and disporting themselves, in open water among the ice, on the very brink of the American Falls. These birds were closely watched for some considerable time, on each occasion, and apparently not one was swept over, although they were diving so close to the edge that it appeared nothing short of miraculous that they were able to prevent themselves from being hurled over the edge of the cataract by the rushing, curving waters.

Charitonetta albeola (Linnaeus). BUFFLE-HEAD.—Formerly of fairly frequent occurence on the Niagara River, during the migration periods; but the comparative scarcity of recent records would indicate that the Buffie-head is becoming a somewhat rare duck in this particular area.

Clangula hyemalis (Linnaeus). OLD-SQUAW.—Of common occurrence in the vicinity of Niagara Falls, during both spring and autumn migration seasons, while it is also occasionally observed in mid-winter. Sometimes, during the spring migration, large flocks of this species gather in the Niagara River, usually keeping well out from the shore lines; but we have, on one memorable occasion, seen this splendid duck make its spectacular dive from the air within a few yards of the river bank, near the village of Chippawa.

Histrionicus histrionicus histrionicus (Linnaeus). EASTERN HARLEQUIN DUCK. — Mitchell[17] records three female or immature duck of this species, seen in the Canadian rapids above the Niagara Falls on December 23, 1933. This is the only record which we know of on the Ontario side of the river; but the Harlequin has been reported on several occasions by observers on the New York side of the Niagara River.

Somateria spectabilis (Linnaeus). KING EIDER. — No knowledge of any recent occurrences within the area. Eaton[18] gives a Niagara River record for December, about 1891, but this probably refers to the New York side, and its inclusion in this list on the strength of that record is perhaps scarcely justified.

Melanitta deglandi (Bonaparte). WHITE-WINGED SCOTER. — Not a very common bird at Niagara, but certainly the most frequently observed of the three species of Scoter which occasionally appear in the river immediately below the Falls. Three were seen in this section of the Niagara River on October 23rd and four on October 24th, 1926, a lone individual on October 20th, 1929, as many as 20 at various times between October 25th and December 17th, 1933.

Melanitta perspicillata. (Linnaeus). SURF SCOTER. — Apparently a rare duck in the vicinity of Niagara. No first-hand knowledge of its occurrence until recently. Two or three females or immature males were observed below the Falls at different times between October 9th and November 4th, 1933; while during that same period, namely, on November 1st, a beautiful adult male was seen resting on the rocks near the Maid-of-the Mist landing.

Oidemia americana Swainson. AMERICAN SCOTER. — Although it is not by any means common, the frequency of the occurrence of the American scoter in the river below Niagara Falls during the autumn of 1933 inclines us to the belief that this duck has been present but overlocked in previous years.

Erismatura jamaicensis rubida (Wilson). RUDDY DUCK. — Occurs sparingly but regularly at Niagara Falls, during the autumn migration period. We do not appear to have any spring records of the occurrence of this duck in the Niagara district; all examples recorded, in any year, having appeared within a very restricted period between the 15th and 31st of October.

Lophodytes cucullatus (Linnaeus). HOODED MERGANSER. — An example of this smaller Merganser, apparently an immature male, appeared on the wide expanse of water below the Falls, on November 14th, 1932, in company with about eight American Mergansers, two Horned Grebes and a Common Loon; while two other immature, or female, birds of this species were seen at the same place, in a similar mixed concourse of duck and grebes, on November 12th, 1933.

17. *Auk*, 51: 392, 1934.

18. *Birds N.Y.* 1: 220, 1910.

Mergus merganser americanus Cassin. AMERICAN MERGANSER. — This handsome Merganser is a common visitor to the Niagara River during both spring and autumn migration season. In some years, it is present on the upper river, in considerable numbers, during January and other mid-winter months.

Mergus serrator Linnaeus. RED-BREASTED MERGANSER. — A fairly common bird on the Niagara River during both spring and autumn migrations. Occasionally observed in mid-winter but not so frequently or in such large numbers as the preceding species.

Cathartes aura septentrionalis Wied. TURKEY VULTURE. — On several occasions, during May and June, 1935, Turkey Vultures were observed circling over the extensive woodland areas near Warner in Lincoln County. W. E. Hurlburt saw no less than four in this vicinity on the ninth of June.

Astur atricapillus atricapillus (Wilson). EASTERN GOSHAWK. — An immature example of this species was shot near Vineland on or about December 20, 1935, and later sent to the Royal Ontario Museum for preservation. Our lack of any other records would tend to indicate extreme rarity in this area.

Accipiter velox velox (Wilson). SHARP-SHINNED HAWK. — Cannot be considered anything but a rare visitor to this district. It is perhaps of more frequent occurrence in Lincoln than in Welland County.

Accipiter cooperi (Bonaparte). COOPER'S HAWK. — Apparently of somewhat rare occurrence. A hawk of this species was seen dead on September 21, 1932, having been shot by a farmer near Vineland. Laing[19] records seeing two or three at Beamsville between September 17, and November 30, 1918. More recently, one was caught in a Starling trap at Vineland, on September 14, 1934, and another in the same trap a year later, on September 18, 1935.

Buteo borealis borealis (Gmelin). EASTERN RED-TAILED HAWK.—Not by any means a common hawk, but is occasionally to be met with in the Niagara district during the autumn migration season.

Buteo lineatus lineatus (Gmelin). NORTHERN RED-SHOULDERED HAWK. — A reasonably common summer resident and probably the most plentiful of the *Buteo* hawks in this district. A few of the older, larger woodlots, with tall trees, afford nesting sites for a pair of these hawks.

19. *Can. Field-Nat.* 34: 22, 1920.

Buteo platypterus platypterus (Vieillot). BROAD-WINGED HAWK. — Observed on several occasions in Welland County and is believed to occur sparingly throughout the district; but it is certainly not a common species.

Buteo lagopus s.-johannis (Gmelin). AMERICAN ROUGH-LEGGED HAWK. — Apparently of fairly frequent occurence during the autumn migration. There is evidence that this species also occasionally occurs in mid-winter, for there is a preserved specimen in the possession of Mr. N. H. Culp, which we understand was shot at Vineland Station about the first of January, 1922. This hawk has, on one or two occasions, been shot by pheasant hunters in the Niagara district, and there is a mounted bird in Dr. Whytock's office at Niagara Falls which is stated to have been obtained near Queenston. Several were seen, and one shot and winged, near Smithville in Lincoln County on November 4th, 1933.

Aquilla chrysaëtos canadensis (Linnaeus). GOLDEN EAGLE. — There is a fine mounted specimen of a Golden Eagle in the possession of Miss Louise Sheppard, of Queenston, which we understand was shot by the late Major James Sheppard in the winter of 1890. Judging by the somewhat small size, and the beauty of the plumage, this specimen would appear to be adult male, newly moulted and in the prime of life. We know of no other definite record of a Golden Eagle in this district, and Major H. C. Sheppard tells us that as far as he is aware the bird mentioned here is the only one of its kind taken among the hundred or more Eagles shot by his father at Queenston during the period 1882-1907.

Haliæctus leucocephalus alascanus Townsend. NORTHERN BALD EAGLE. — An immature Bald Eagle, with a small amount of white marking on the head, was shot near Jordan ponds by a local farmer on August 28, 1929. It is stated to have been in the vicinity for about two weeks previous to the date of shooting. Upon examination its stomach was found to contain fish. A second immature example was shot and winged near Jordan early in March, 1933. This bird was kept alive for some time by Chas. Mitchell, of that locality, and was later obtained by the writers and released at Niagara-on-the-Lake about the end of May. Mr. H. St. Clair Fisher of Niagara Falls has in his possession a mounted specimen of this Eagle which he shot on the river bank at Queenston on or about October 15, 1922. This specimen, which has been examined by the senior author, is apparently a female in its first or second year and is remarkable for its great

size. Mr. Fisher tells us that, when in the flesh, it was stated by the taxidermist to have weighed 16 lbs., to have measured well over 45 inches in length, and to have had a wing spread of 9 feet 4 inches. Major H. C. Sheppard of Queenston has informed us that between the years 1882 and 1907 his father, Major James Sheppard, shot up to one hundred American Eagles along the river bank near Queenston. The lower Niagara River at Queenston must have been much favoured by Eagles in those days for we are told by Major Sheppard that several were shot nearly every winter, and that sometimes as many as eight or ten in a season were procured for preservation as mounted specimens. There is an old and interesting record given by the Rev. Mr. Hibbert Langille[20] of the Bald Eagle nesting on the bank of the Niagara River at Chippawa, about fifty years ago. On several occasions during the past few years, Eagles have been reported as having been seen within the Niagara River gorge; but, unfortunately, we have no personal sight records to substantiate these reports.

Circus hudsonius (Linnaeus). MARSH HAWK. — A common summer resident in Lincoln and Welland Counties and the most conspicuous, if not the most plentiful, raptore occurring within the area. It would seem probable that this hawk occasionally overwinters here for we have a February record for Lincoln County, and in Welland County it has been observed as early as March 5th.

Pandion haliaëtus carolinensis (Gmelin). OSPREY. — We have no personal observations of this fine hawk to record, but Laing[21] reports seeing a beautiful adult at Beamsville on Sept. 20, 1918, and there is a mounted specimen in a restaurant at Grimsby which is believed to have been obtained locally.

Falco peregrinus anatum Bonaparte. DUCK HAWK. — A falcon of this species was shot near the Lincoln-Haldimand county line, in the vicinity of Canboro, on October 9, 1933, by V. Juhlke of Vineland.

Falco sparverius sparverius Linnaeus. EASTERN SPARROW HAWK. — A fairly common summer resident, arriving in this district soon after the middle of March. There is no doubt that this small hawk quite frequently overwinters in this section of the country; for we have winter records almost yearly from the Vineland area, while, during recent winter seasons, several have been observed at Niagara Falls and other points in Welland County.

(To be continued)

20. *Our Birds in their Haunts*, p. 453-5, Boston, 1884.

21. *Can. Field-Nat.* 34: 22, 1920.

ADDITIONAL NOTE ON THE PRESENCE OF THE EUROPEAN STARLING AT CAMROSE, ALBERTA

By E. R. KALMBACH,
U.S. Biological Survey, Denver, Colorado

IN MAY, 1935, the writer, traveling northward through Alberta stopped at Camrose to gather details of the nesting of a European Starling (*Sturnus vulgaris*) east of that place in 1934, an incident since reported by Frank Farley (*Canadian Field-Naturalist*, Vol. 49 p. 119).

It was my good fortune to meet Lawrence Blades, school teacher at the Hartland school, 14 miles east of Camrose, in the belfry of which the Starling had nested. From him were obtained the following notes on the presence of a Starling in that vicinity subsequent to the collecting of the eggs.

A single Starling was seen on several occasions late in the autumn and early in the winter of 1934 in the region east of Camrose. It finally took up its abode in a barn some 5 miles north of the Hartland school. It was not seen during January and February, 1935, but what appears to have been the same bird reappeared early in the spring. On about May 10 it was caught in the loft of the barn mentioned, and after two days of captivity it died.

It was the writer's good fortune to arrive on the scene soon thereafter and to find the specimen still in Mr. Blades' possession. He kindly relinquished it in order that it might be preserv-

ed. The skin, bearing collector number E.R.K. 6739, has been deposited in the collection of the University of Alberta, at Edmonton.

The bird was a female, in a much emaciated condition and its ovaries were moderately enlarged. There are reasons for believing that only a single bird is involved in these observations as well as those recited by Mr. Farley. It is likely also, as Mr. Taverner has suggested, that the incident is a case of box-car transportation rather than a natural extension of range. The writer is unaware of Canadian records of the European Starling west of Manitoba.

NOVA SCOTIA MAMMAL NOTES

By V. E. GOULD
Wolfville, N.S.

Sorex arcticus arcticus Kerr. AMERICAN SADDLE-BACKED SHREW. — Hitherto there have been but two recorded instances of the occurrence of this shrew in Nova Scotia and both of them are from the same locality. The first was taken on the lawn of Mr. H. S. Cruickshanks at Harmony, one and three-quarter miles east-south-east of Truro on July 6, 1920; and the second was found dead in the same locality on September 6, 1923. Both specimens are now in the Provincial Museum at Halifax, preserved in alcohol. It now gives me pleasure to establish another locality in the province for this exceedingly rare animal, after a lapse of twelve years. Two specimens, male and a female, were captured by the writer at Grand Pre, Kings County, about a quarter of a mile west of the D. A. Railway station, from among the diggings of the Star-nosed Mole (*Condylura cristata*) in swampy ground immediately beside the railway track. The female was caught on April 27, 1935, and the male on April 30, 1935. A concentration of traps in the general locality failed to result in the capture of any more of this species.

Measurements:

Male: Length 118 mm. Tail 45 mm. Hind Foot 15 mm.

Female: Length 116 mm. Tail 41 mm. Hind Foot 14 mm.

Microsorex hoyi thompsoni (Baird). THOMPSON PIGMY SHREW. — This is another species of Shrew which is to be considered rare and local in the province. It has been recorded from Ingonish Centre, Digby and Little River, Digby Neck (Jackson, *Taxonomic Review of the American Long-tailed Shrews, genera Sorex* and *Microsorex*, N.A. Fauna No. 51, 1928) and more recently at Maxwelltown, Digby County, and Caledonia, Queens County, by Morris M. Green, April, 1930 (*in litt.*, by permission). Also there is a specimen in the Provincial Museum. Halifax, which was collected by J. Perrin on February 20, 1904, at MacNab's Island, Halifax Harbour.

It is now known to occur on the "Ridge" near Wolfville. On April 5, 1935, I collected a male on the dry hillside (southern exposure) grown up irregularly with small conifers and wild apple trees. The animal was taken at a small pile of loose rocks, above 100 yards south-east of the locally famous "Stile". No more turned up in the concentration of traps that followed for a week afterwards.

Measurements:

Male: Length 88 mm. Tail 32 mm. Hind Foot 10 mm.

Myotis keenii septentrionalis (Trouessart). LONG-EARED BROWN BAT. — In the gypsum mining localities of Hants County, N.S., and probably other places in the province where this industry is carried on, there have been excavated a number of caves of greater or lesser extent, and these are favourite gathering places for bats, used for roosting in summer and for hibernating in the winter. On February 11, 1935, one of these localities, a cave at Cheverie, Hants County, was visited by myself and Mr. R. W. Tufts. In this cave, which extended about 75 yards into the earth and was about twenty feet wide and ten to fifteen feet high, a small colony of the above named species was found. There were countless crevices and niches all over the cave which seemed likely to provide shelter for them, but all we could find, thirty-six in number, were gathered in a small side chamber drilled in the roof near one side. They clung there, head downward, to the sides and roof, singly and in small groups. Most of them however were found tightly packed in two drill holes in the roof, which were about five inches deep and one and a half inches in diameter. When light was turned on them and efforts were made to dis-

lodge them they squeaked vigorously and opened their tiny fox-like mouths threateningly. When drawn out of their retreat they fell helplessly to the ground and moved about feebly. Most of those clinging to the walls had a silvery covering of condensed moisture which so made them resemble the walls that close observation was required in locating them. Most of them were apparently almost incapable of movement. However there was one which flew away briskly when an attempt was made to pick it up and another flew away at our approach. This was surprising for the temperature was below the freezing point that day. Twelve specimens were collected which later proved to be males without exception. In a warm room, they slowly revived and flew about. They kept alive and active in a warm room. The next morning much excrement was found to have been deposited.

Average Measurements of five specimens:

Length 90.8 mm. Tail 40.8 mm. Ulna 37 mm. Metatarsal 32.6 mm. 1. Metatarsal 32.1 mm. 2. Metatarsal 32.4 mm. 3.

STOMACH CONTENT ANALYSES OF FISHES PREYING UPON THE YOUNG OF PACIFIC SALMON DURING THE FRY MIGRATION AT McCLINTON CREEK, MASSET INLET, BRITISH COLUMBIA

By A. L. PRITCHARD,

Pacific Biological Station, Nanaimo, B.C.

AS ONE PHASE of the investigation of the efficiency of natural propagation of Pink Salmon, *Oncorhynchus gorbuscha,* conducted at McClinton Creek, Massett Inlet, British Columbia, since 1930, an attempt has been made to determine what fish prey upon the eggs and fry of the species and to ascertain the loss sustained through the activity of such predators. For this purpose collections of Cottids, Dolly Varden Char, Cut-throat Trout, and Coho Salmon yearlings were made from February to June in the springs of 1931 and 1933 as follows:

	1931	1933
Cottids—*Cottus sp.*	81	84
Dolly Varden Char—*Salvelinus malma*	62	14
Cut-throat Trout—*Salmo clarkii*	11	
Coho Salmon—*Oncorhynchus kisutch*	365	20
*Mixture of Coho Salmon and Cut-throat Trout	1067	456
	1586	574
		2160

Table I presents the data arising from the analyses of the stomach contents of the fish in the samples listed above.

Before passing final judgment on the basis of the evidence in Table I, it is necessary to consider the conditions under which the samples were taken. In order to count the young of the various species of Pacific Salmon which are migrating seaward in the spring of the year, a barrier of fine wire screening has been constructed across the entire width of the stream. This structure halts the downstream migration of all fish larger than the smallest fry, and since it is built at an angle to the flow of the river, serves to guide them into a large rectangular pen at the lower end, from which they may be taken, counted and examined. Thus, when the runs are at their height, there is a concentration of fry along the screens and in the pen, and there is little doubt but that, during this temporary crowding, the small fish more easily fall prey to their predators. It has been noted that these same predators, the Cottid, the Dolly Varden Char, the Cut-throat Trout, and the Coho Salmon yearling, appear in large numbers immediately after dusk when the daily downstream migration begins and make excellent use of the opportunity for extra food which is afforded. Therefore, even though the results of the analyses may be more extreme than those which would be obtained under natural conditions, they do demonstrate the fact that much damage will arise from "enemy" fish, should there occur unnatural circumstances which produce a concentration of fry.

There appears to be a close similarity in the average number of Pink Salmon fry taken in the stomachs of a given predator in the two years, 1931 and 1933. The relative size of the

*Pressure of work prevented individual identification of the fish in these collections at the time when they were captured. Over ninety per cent. of the total were young Coho Salmon.

Table I. — ANALYSES OF CONTENTS OF FISH TAKEN AT MCLINTON CREEK, MASSET INLET, B.C., DURING THE SPRINGS OF 1931 AND 1933.

	Cottus sp.		*Salvelinus malma*		*Salmo clarkii*	*Oncorhynchus kisutch*		*Oncorhynchus kisutch* & *Salmo clarkii*	
	1931	1933	1931	1933	1931	1931	1933	1931	1933
Size	1¾"–7"				2¼"–7"	2"–6¼"	3¾"–4½"		
No. examined	81	84	62	14	11	365	20	1067	456
No. empty	59	39	5	1	6	75	1	170	18
Number containing									
1 pink salmon fry	7	13	5	2	2	46		153	68
2 — —	3	12	3	2	1	56	3	212	123
3 — —	3	9	3	3	1	73	6	220	119
4 — —	5	6	5			65	6	124	79
5 — —	1	2	7		1	20	2	80	32
6 — —		1	7	1		13	1	36	15
7 — —			4			7		24	2
8 — —	1	2	4	1		6		8	
9 — —			4			2		1	
10 — —			3			1	1	2	
11 — —			2	1					
12 — —			2	1					
13 — —			2			1		1	
14 — —			1						
15 — —			1	1					
19 — —			1	1					
22 — —			1						
23 — —			1						
Tot. pink salmon in stomachs	55	120	408	86	12	953	74	2623	1251
Av. No. per stomach	.7	1.4	6.6	6.1	1.1	2.7	3.7	2.5	2.7
Total Chum Salmon fry	2		76			10		33	
Total Coho Salmon fry and fingerlings	8	2	46			34	1	8	2
Stomachs containing insects		1		1				16	1
Stomachs containing fish eggs								4	1
Miscellaneous materials			2 trout					*	†

13. Stomachs contained unidentifiable fish remains.
1. Stomach contained a spider.

figures would indicate that the most voracious of the enemies is the Dolly Varden Char, followed by the Coho Salmon, the Cut-throat Trout and the Cottid respectively.

These data alone, however, may not be used to assess the absolute damage caused to the young salmon by any one species in the river. For such a determination it is essential to know as well the actual numbers of the predator in the stream. Unfortunately no such counts are available, but from general observation we are led to the conclusion that from the point of view of absolute damage the order, from greatest to least, is probably: Coho Salmon, Cut-throat Trout, Dolly Varden Char, and Cottid.

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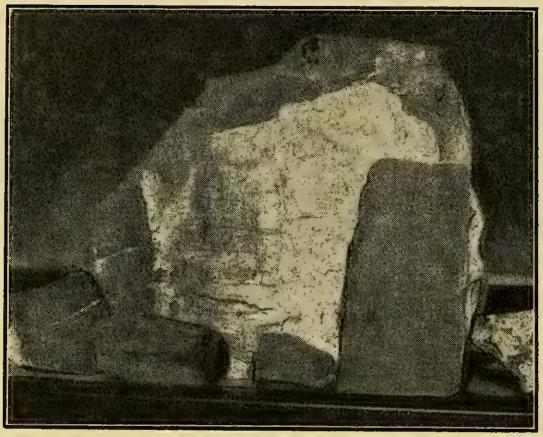
DEVONIAN FOSSIL WOOD FROM KETTLE POINT, LAKE HURON

By J. W. RUSSELL, M.A.
University of Western Ontario

THE ORIGINAL exposures of black shales at Kettle Point were in the form of a bluff some fifteen feet high about two miles west of Ipperwash Beach. The lake water reached almost to its base, with but a narrow fringe of slaty shales along the water's edge. The recent recession of Lake Huron has changed the shore line materially. Instead of a narrow fringe of shales exposed, we have hundreds of acres extending broadly from the former bluffs towards Ipperwash Beach, and extending in an anticlinal fold over a mile northwards into the Lake as shown in the above photograph.

The original exposures have been visited by many eminent geologists, but only within the past year or so has an abundance of fossil wood been found chiefly along the anticline in the shales. The carbonaceous character of these shales and their kettle shaped concretions have been known since Alexander Murray's report in 1855. J. W. Dawson in his reports prior to 1871 described a number of small Devonian plants from these shales. In the original exposures in the bluffs and along the shore, the wood has been coalified and the plant fibres are so poorly preserved that complete identification is difficult. The wood found recently along the anticline was completely silicified before disintegration took place and the preservation of much of it is almost perfect.

More than ten years ago, the writer noted the impression of a tree stem in the shales with portions of the wood in the form of coal. This is in the museum of the University of Western Ontario, and indicates a tree stem over four inches in diameter. In 1927 Dr. Hotson of Park Hill found highly silicified pieces of wood with diameters up to six inches on the shore from which the lake had receded. On seeing them, I requested him to send them to the University for sectioning and microscopic study. I discussed these finds with my classes in geology and pointed out their probable importance. During the summer of 1934, one of the students, Mr. J. W. Patterson of London, Ontario, had an opportunity to go over the exposed beach at Kettle Point and was successful in finding more



than a dozen pieces, the largest of which indicated a tree trunk more than fifty-six inches in circumference and three feet long. This piece is shown in the photograph. The slab standing upright in the photograph shows the remarkable preservation of the wood fibre and has been tentatively identified by Professor R. B. Thompson of the University of Toronto, as a species of Callixylon, while the large piece appears similar to *Prototaxites logani* from Gaspé described by J. W. Dawson in his reports on the *Fossil Plants of the Devonian* Part I, 1871, and Part II, 1882.

Professor Hart, Head of the Department of Botany at the University of Western Ontario, has undertaken a complete microscopical examination of all this wood to complete its determination.

The most interesting feature of these finds, for the geologist, is the silicification of all the wood found along the axis of the anticline in the shales, while less than a mile westwards the wood has been changed into coal. The structural features of the shales must be the explanation. During the arching of the anticline sufficient fracturing occurred to allow the circulation of silica-bearing water which also would be heated probably. Such conditions would bring about the speedy silicification of the wood. Only one piece shows even incipient decay before silicification took place.

About three-quarters of a mile east of the anticline in the shales, is another anticline in the Ipperwash limestone, and along its axis numerous flinty concretions occur. These two anticlines seem to represent the most northerly extension of the Cincinnati arch which is known to extend across Lake Erie into Ontario, and, as such, would be an adequate explanation of the silicification of the wood buried in the shales. There is no indication that these trees grew in place. The general appearance of the pieces indicates trunks that drifted into the shales, and there became buried.

Scarcity of fossils in these shale beds makes their age somewhat problematical. Of the fossils, the large fish bones (*Dinichthys*) indicate Late Middle, or Early Upper Devonian. Dr. E. M. Kindle has correlated the Kettle Point shales with the Huron Black shales of Ohio. Clinton R. Stauffer in the *Devonian of South Western Ontario,* (Memoir 43 Geol. Surv. Canada) has discussed rather fully the stratigraphic position of the Kettle Point Shales, showing that they lie directly above the Ipperwash dolomite (Delaware) of the Hamilton formation. At the top of the Kettle Point shales occur some thin layers of yellowish green sands similar to those at the base of the Chemung and this may be taken as the logical disconformity separating the Middle Devonian from the Upper.

THE LEECHES OF LAKE NIPISSING

By J. PERCY MOORE

IN A BIOLOGICAL survey of Lake Nipissing, Ontario, extending over the summers from 1929 to 1934, Mr. J. P. Oughton and his associates accumulated a fairly large and representative collection of leeches from both shore collecting and dredging. These were sent to me for determination by Mr. Oughton and Superintendent LePan of the Royal

Ontario Museum of Zoology. While the collection contains nothing new, the depth records are of interest and it is also of value to place the determinations on record as a contribution to the geographical distribution of leeches in Canada and for comparison with the leech-fauna of other Canadian lakes. The full list of stations and data is not given as it is expected that Mr. Oughton will do this in his forthcoming report.

Of the 16 species listed herein 11 only were actually taken in Lake Nipissing, the remaining 5 in nearby small lakes and rivers. This compares with 14 species recorded from Lake Nipigon (Moore 1924), 17 from Georgian Bay (Ryerson 1915), 3 from Lake Simcoe (Rawson 1928), 9 from Jasper Park lakes (Bere 1929), 15 from Lake Erie (Moore, 1906) and 17 from various localities in southern Canada (Moore 1922). The total number of Canadian species recorded in all of these papers is 25.

GLOSSIPHONIDAE

GLOSSIPHONIA COMPLANATA (Linn.)

This usually abundant and widely distributed species is represented by only three specimens from Lake Nipissing and one from the Memorial Park at Huntsville, in a rivulet. Of the former one came from a marsh at the mouth of Bass Creek, one from Sturgeon River in 12 feet and one dredged between Blueberry Island and Franks Bay in 99 feet of water on a bottom of soft mud. As commonly happens they were associated with *H. stagnalis,* another species of similarly wide distribution, and with *E. punctata.* On all of those from the lake the dark paramedian stripes are faintly developed.

GLOSSIPHONIA FUSCA Castle

Somewhat surprisingly only a single example of the typical variety was taken with *H. stagnalis* among stones in water 1 foot deep in Perch Lake. This species is generally common in cold, clear water.

HELOBDELLA STAGNALIS (Linn.)

One of the commonest leeches in warm, shallow waters and found in Lake Nipissing at Franks Bay, Goose Island, Bass Creek and in Perch Lake and Don River near Toronto, associated with *G. complanata, G. fusca, E. punctata* and *H. grandis.* Usually on stones in water 1-3 feet deep. Also dredged at the following stations: IV D3, near mouth of Franks Bay, 63 feet; IV D5, same, 93 feet; VI D4, between Franks Bay and Blueberry Island, 99 feet; XII D4, near Blueberry Island, 69 feet; IX D5, mouth of Campbells Bay, 64 feet; XII D1, same, 63 feet, all with bottom of soft mud. Only one, taken July 4, 1930, in 63 feet, bears young. The occurrence of this species at the greater depths is unusual. All of the numerous examples from Lake Nipissing are small and most of them have the nuchal plate little developed.

HELOBDELLA NEPHELOIDEA (Graf)

One specimen dredged from South Bay (XXIII D1, depth 3 feet) and three from Manitou Island (LII D1, depth 51 feet) constitute the representation of this species.

PLACOBDELLA PARASITICA (Say)

Five lots, with one exception single specimens, taken from the exterior of snapping turtles or free-living in shallow water, in one case with *P. rugosa,* from Bass Creek, Sand Creek and Franks Bay.

PLACOBDELLA RUGOSA (Verrill)

This is another shallow water species usually found free-living attached to the under side of stones, floating wood, etc., and appears to be common, although all but two lots are single specimens. Taken alone or with *P. parasitica, E. punctata* or *H. grandis* in Perch Lake, South Bay, Franks Bay and Bass Creek. One taken at South Bay, July 25, 1930, bears many young.

PLACOBDELLA PICTA (Verrill)

A single typical example measuring in contraction 6.3 x 4.2mm was taken attached to a *M. decora* in a small muskeg lake near Lake Nipissing on July 15, 1934, by P. E. T. Fry.

PLACOBDELLA MONTIFERA Moore

This also represented by a small example 7 x 2.8mm. taken by Mr. Oughton on August 7, 1930 attached to a stick close to shore in Perch Lake. Commonly it attacks frogs, toads and mussels.

ICHTHYOBDELLIDAE

PISCICOLA PUNCTATA Verrill

Taken in considerable numbers principally as an ectoparasite of *Stezostedon vitreum,* along with "fish lice" and trematodes to a recorded depth of 45 feet at Franks Bay, Blueberry Island and West Bay.

ERPOBDELLIDAE

ERPOBDELLA PUNCTATA (Leidy)

An abundant species in shallow water from 6 inches to 3 feet deep, associated with *H. stagnalis, P. rugosa* and *Dina parva* at Goose Island, West Bay, Bass Creek, South Bay, Franks Bay and also in the Don River at Toronto. Also an immature one 5mm. long and somewhat doubtfully determined was dredged with *G. complanata* in Sturgeon River about one mile above the lake in 12 feet of water on a bottom of sand and mud, and an egg-pouch probably of this species

with *H. stagnalis* near Blueberry Island on a soft mud bottom at a depth of 69 feet. One example from Goose Island has both the male and female orifices shifted caudad one-half annulus to the middle of XII *a2* and XII *b6* respectively.

DINA PARVA Moore

Apparently quite common in very shallow water under rocks along shore with *H. stagnalis*, *E. punctata* and *H. grandis*, especially in and near Franks Bay and on Goose Island. None were in the dredgings from deep water. Pigment spots generally are totally lacking. On one specimen the gonopores are separated by three instead of the usual three-and-one-half annuli.

DINA FERVIDA (Verrill)

Taken sparingly at only two stations: Goose Island July 22, 1930, depth 3 feet, and Franks Bay August 30, 1934, 6 inches, on stones.

DINA MICROSTOMA Moore

The sole record of this species is two specimens from Trout Lake, near North Bay, collected by F. E. J. Fry, July 9, 1932.

HIRUDIDAE

MACROBDELLA DECORA (Say) Verrill

This species was not found in Lake Nipissing itself but two in Perch Lake, August 3, 1933, and two in a small muskeg lake on July 15, 1934. With the latter was a *Placobdella picta*. Only one measuring 70 x 16. x 4.3mm. was sufficiently mature to have the copulatory glands fully developed. All are very dark coloured, nearly black above, and, while the median series of red spots is conspicuous, the lateral black spots are absent, or at least invisible.

HAEMOPIS MARMORATIS (Say)

Found only on Iron Island, July 20, 1929. Nine very dark, heavily blotched specimens of medium size along with one *H. grandis*.

HAEMOPIS GRANDIS (Verrill)

Probably very common as the species is represented by fifteen bottles, most of which however, contain a single specimen only, though one lot consists of sixteen. With the exception of one taken from a pickerel brought up in a gill net from a depth of 25 feet near Goose Island, all were taken in shallow water along shore. The localities are Franks Bay, Iron Island, South Bay, and Mattagami River, Kapuskasing, collected by R. V. Whelan. The living colour of the latter was noted as green. With the exception of several which exhibit moderate blotching, the specimens are very sparsely spotted, some almost immaculate. Usually the gonopores are in the typical positions in the furrows XI *b5--b6* and XII *b5--b6* but a few show a tendency for them, especially the female, to shift slightly into the following annulus (*b6*). Recorded as feeding on *Physa*.

LIFE HISTORY NOTES AND GROWTH STUDIES ON THE LITTLE BROWN BAT, Myotis lucifugus lucifugus

By J. R. DYMOND

THE OCCURRENCE of a colony of Little Brown Bats, *Myotis lucifugus lucifugus* (Le Conte), in the attic of an old house used as a temporary laboratory by the Fisheries Research Laboratory, Department of Biology, University of Toronto, afforded opportunity for making the following observations. The house was located on Lake Nipissing at Franks Bay, near the point where the French River leaves the lake. It was within ten yards of the water.

In most of the seven summers, 1929-1935, during which the old house was used as laboratory and living quarters the colony consisted of a hundred or more bats. During the summer of 1934, one hundred and two were collected and a number, perhaps twenty, remained at the end of the season. During the day most of the bats composing this colony clustered in the gable close to the chimney with which the cook stove was connected. In 1934 Mr. D. A. MacLulich found bats at the laboratory on April 17th. How long they had been there was not known.

In July, 1934, when the colony was first studied carefully, all the adults present were females. The late Prof. B. A. Bensley in a paper read before the Brodie Club reported that of 31 bats of the same species which he captured on July 8, 1927, at McGregor Bay, Manitoulin District, Ontario, all of the 19 adults were females. The latter colony, which had established itself only that year in the building from which they were collected, consisted of not more than forty individuals. In 1935 Mr. F. E. J. Fry found two adult males in the Franks Bay colony. Observations made during the summers of 1931, 1932 and 1933 support the idea that this colony consisted almost entirely of females.

Of 42 adult females taken in July, 1934, three were carrying unborn young. One of these was taken on July 7 and two on July 9. The 54 young taken between July 7 and July 26 ranged in total length from 45 mm. to 89 mm. (See Table 1). The sizes and dates of capture of some of the smaller young were as follows: 45 mm., July 7; 51 mm., 2 specimens on July 9; 52.5 mm., July 11; 54 mm., July 9 and July 13; the latter specimen when taken still had the umbilical cord attached. On the other hand, well-grown young were taken quite early in July, for instance an 88 mm. immature was taken on July 7, on the same date other immatures of the following sizes were also taken 77, 76, 69, 67, 67, 66, 66, 65, 61 and 60 mm. There is no means of knowing how old these were at this date. It is apparent, however, that young are born in June and the first half of July. Of the 19 adult females taken by Prof. Bensley on July 8, 1927, two contained unborn young.

Table 1 gives weights and measurements of various body parts of bats of different sizes. The three foetuses for which data are included in this table were 45, 47 and 49 mm. in total length and, after surface moisture had dried, weighed respectively 1.97, 2.3 and 2.25 grams. The table also indicates that one of the young captured after birth was no longer and but little heavier than the smallest of these foetuses. Prof. Bensley gave 50 and 47 as the total length of a foetus and sucking young respectively. It is therefore evident that the young when born are 45 to 50 mm. in total length (30 mm. body length) and weigh approximately 2 grams. In this connection it is interesting to compare the weight of the foetus with that of the female carrying it. These were as follows, for the three pregnant females already referred to:

Weight of foetus	Weight of female including foetus	Weight of female less weight of foetus
1.97 gms.	11.28 gms.	9.31 gms.
2.3	11.36	9.06
2.25	13.23	10.98

In the case of each of the three pregnant females taken at Lake Nipissing and the two taken by Prof. Bensley, only one young was produced. As described by Prof. Bensley, "this lies crosswise in the abdomen of the female in such a way that the weight is evenly divided as between right and left, properly ballasted for flight".

Prof. Bensley thus described the method of carrying the suckling young: "The female has two nipples, pectoral in position. The single young is attached to a nipple and so firmly affixed that the marsupial method of lip fusion and expansion of the nipple inside the mouth of the young is suggested. The young lies crosswise of the mother's body and clings by means of the mouth to the nipple of one side and by the claws of the hind limbs to the fur of the other side in a position beneath the mother's wing. When forced out of this position the young shows some anxiety to get back to it and readjusts the position promptly. When looked at from the back, the mother shows no great sign of the presence of the young underneath her, except for an occasional bulging and movement at the base of one of the wings. This gives the impression of a bundle tucked under the arm". Our observations suggest that the thumb as well as the claw of the hind foot is used by the young in clinging to the mother.

The total length and weight of each of the four specimens which we found being carried by females are as follows: 52.5 mm., 3.31 gms; 57 mm., 3.75 gms; 60 mm. 3.38 gms; 65 mm., 4.98 gms.

The young appear to be well grown before they undertake independent flight. One specimen, 79 mm. in total length and 6.39 gms. in weight, was not able to fly, whereas another, 84 mm. long and weighing 6.3 gms., could fly fairly well.

The young bats are practically naked until they reach a total length of about 60 mm.; at about 70 mm. in total length, short, sparse, silky hair first appears to cover them. They then appear ashy with a light brownish tinge due to the brownish tips of the hairs. By the time they are 75 to 80 mm. in length, they are covered with hair nearly as long as that of the adults. In colour, however, they are a dark slate with only slight brownish tinge.

The sex ratio of the 57 immature (including the 3 foetuses) was almost 2 males to 1 female, the actual numbers being 37 males to 20 females. Of 28 collected on July 17, 1933, 19 were males and 9 females, and 2 or 3 of the latter were adults, all the males being immature.

Relative Growth of Body Parts

Table 1 presents the average measurements of various body parts of young of different sizes as well as of adults. The striking feature of these measurements is the relatively large size of the foot and thumb of the young even before birth. This condition is no doubt correlated

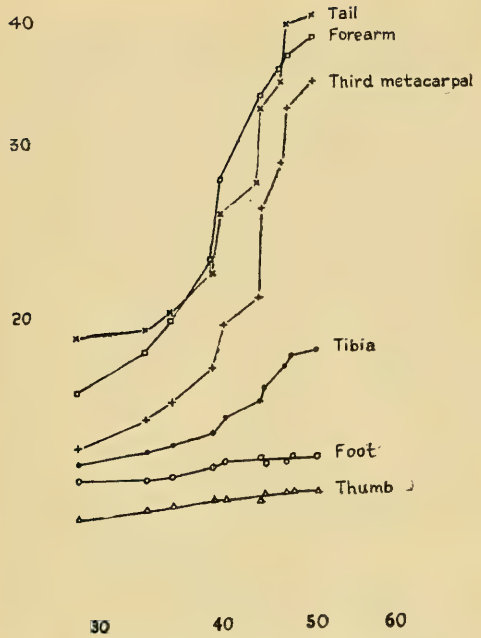


FIGURE I showing rate of growth of some body parts associated with flight membranes in comparison with growth of body length. Logarithms of length of body parts plotted as ordinates against logarithms of body length as abscissae.

with the fact that these parts function immediately on birth in connection with the clinging of the young to the mother. Figure 1 presents graphically the facts with reference to the increase in size of the tibia, forearm, tail and third metacarpal, as well as of the foot and thumb. Averages for these body parts are plotted against medians for the length groups, body length being used as the dimension for reference. Two features of the growth of the tibia, forearm, metacarpal and tail are brought out by these curves, viz., the relatively great increase in size of these parts with growth of the body (distinct positive heterogony), as compared with the small increase of the foot and thumb (negative heterogony), and the fact that all four parts (tibia, forearm, tail and metacarpal), undergo a period of accelerated growth midway in the course of the growth here shown.

This type of growth is undoubtedly related to development of the power of flight, which is dependent on the area of the flight membrane. Fore and hind limbs and tail are all included in the present species in this membrane. If all parts of the body increased at the same rate, power of flight would increase as the square of the length, whereas weight would increase as the cube. What actually happens is that the parts concerned with flight increase at a greater rate than body length, thus increasing the surface area of the flight membranes more rapidly than weight. In this connection, it is interesting to note that the positive heterogony of the forearm, metacarpal and tail is more marked than in the case of the tibia, which is the least concerned in flight of all these four structures.

Examination of Table 1 brings out the following additional features which may be significant. Whereas the third metacarpal is longer than the fifth in the adult and the larger immatures, in still younger specimens the fifth is the longer. Whether in the foetus and newly born young the third is the longer as the present data suggest, cannot be decided now because of the small number of specimens examined. Examination of the figures for the growth of the foot indicate that there is a stage between the 74 mm. size and the 85 mm. size at which the foot decreases in size. Whether the difference between the present figures is significant is perhaps open to question, although it is believed that some change probably occurs in the size or conformation of the foot including the claws at this stage.

TABLE I—MEASUREMENTS OF GROWTH STAGES OF *Myotis l. lucifugus*

Size range mms.	No. of Specimens	♂	♀	Total length	Body length	Tail length	Tibia	Foot	Fore-arm	Thumb	III Mc	V Mc.	Ear from Crown	Spread	Wt. gms.
foetuses															
45-49	3	2	1	47	29	18	8.4	7.3	13.7	5	9.5	9.2	6.5	95	2.17
immature															
45	1		1	45	30	15	9	8	15	5.5	12	10.7	5.8		2.24
50-54	6	3	3	52.8	34.1	18.7	9.1	7.2	16.9	5.5	11.3	11.5	6.9	105.4	2.97
55-59	8	4	4	56.4	36.3	20.1	9.5	7.4	19.6	5.7	12.9	13.2	7.2	120.5	3.275
60-64	8	7	1	62	40	22	10.3	8	22.9	6.	16.1	16.8	8	137	4.22
65-69	10	7	3	66.4	41.1	25.3	11.5	8.4	27.4	6.	19.0	19.5	8.9	156	4.968
70-74	5	3	2	71.8	44.7	27.1	12.6	8.6	33.9	6.	21.7	21.9	10.1	185.2	5.368
75-79	7	4	3	77.3	45.2	32.1	13.8	8.2	33.4	6.2	25.8	25.7	10.5	210	6.14
80-84	5	4	1	81.8	47.4	34.4	15.2	8.3	35.5	6.4	28.6	28.2	12.5	230	6.85
85-89	4	3	1	87.8	48.2	39.6	16.3	8.6	36.9	6.4	32.4	30.8	12.3	244	7.61
Adults															
85.5-97	28	0	28	91.3	51.2	40.1	16.8	8.85	38.1	6.4	34.5	32.7	13.2	262	9.62
Percentage errors				1.92		4.28	3.68	4.65	1.47	3.62	4.44	4.09	1.51		

* Includes 3 carrying foetuses. Mc. Stands for Metacarpal.

AN INTERGENERIC HYBRID (*Agropyron* × *Elymus*) AND SOME OTHER PLANTS FROM ANTICOSTI ISLAND[1]

By J. ADAMS

DURING the year 1935 a third short visit extending from 19 July to 2 August was paid to the island of Anticosti for the purpose of checking some observations made on former visits and collecting specimens generally. As on previous occasions my activities were confined to the western part of the island only. Altogether 21 species were added to the flora of the island as known up to the present. Those introduced by human agency are marked as usual with an asterisk.

POTAMOGETONACEAE

Potamogeton pectinatus L. Swamp near Chateau Menier.

SPARGANIACEAE

Sparganium angustifolium Michx. West Point.

GRAMINEAE

Agrostis maritima Lam. (*A. palustris* Huds.). Sea beach, Port Menier.

**Avena pubescens* Huds. Port. Menier. This introduced species does not appear to have been recorded previously in Canada.

Glyceria grandis S. Wats. Vicinity of Ellis Bay.

Glyceria melicaria F. T. Hubb. Marsh along logging railway.

Puccinellia pumila Hitchc. Sea beach, Port Menier.

Schizachne purpurascens Swallen (*Avena Torreyi* Nash) was collected in the vicinity of Ellis Bay in 1934.

Agropyron repens Beauv. x *Elymus mollis* Trin. (*E. arenarius* var. *villosus* E. Meyer). Reference was made previously (in *Can. Field-Nat.* Nov. 1935) to the supposed hybrid nature of these plants. Further observations were made and a large series of specimens was collected of which some were sent to Washington for examination. Dr. Hitchcock died on his way home from Europe before he had an opportunity of examining this fuller series of specimens but his associate agrostologists had no doubt as to their hybrid nature. In height, length of spike and general robustness the plants were intermediate in character between Agropyron and Elymus. They were also quite glaucous and resembled *Agropyron* in having only one spikelet at each node but in a few cases there were two — in this case approximating the condition found in *Elymus*.

CYPERACEAE

Carex atratiformis Britton. Swamp, Anse aux Fraises.

Carex hormathodes Fernald. Vicinity of Ellis Bay.

C. interior L. H. Bailey. Weir at Anna Lake; also at Anse aux Fraises.

C. retrorsa Schw. On mud, vicinity of Ellis Bay.

C. scoparia Schk. Along logging railway; also vicinity of Ellis Bay.

C. stipata Muhl. Along south road from Port Menier; Anna Lake; swamp, Anse aux Fraises.

Heleocharis palustris R. & S. Vicinity of Ellis Bay.

Scirpus rubrotinctus Fernald. Anse aux Fraises.

JUNCACEAE

Juncus effusus L. Along south road from Port Menier.

ROSACEAE

Geum macrophyllum Willd. Open ground near beacon, west side of Ellis Bay.

ARALIACEAE

Aralia hispida Vent. Open ground along logging railway at junction for Whitehead Lake.

BORRAGINACEAE

Myosotis laxa Lehm. Meadow, vicinity of Ellis Bay.

RUBIACEAE

**Galium tricorne* Stokes. Seashore, Ellis Bay

COMPOSITAE

The record of *Solidago flexicaulis* L. (in *Can. Field-Nat.* Apr. 1934) appears to be an error. A re-examination shows the plant to be doubtless *S. macrophylla* Pursh. with flower-heads somewhat smaller than usual.

[1] Contribution No. 456 from the Division of Botany, Experimental Farms Branch, Department of Agriculture, Ottawa.

1933, A "BLUE JAY YEAR"

By L. L. SNYDER and T. M. SHORTT

ALTHOUGH the Blue Jay [*Cyanocitta cristata*] is regarded as a resident bird in the Toronto area, and also in the general region of the north shore of Lake Ontario, it is known that the species performs a rather dilatory migration. Occasional congregations of Jays in loose flocks during late September and until mid-October are regarded as normal occurrences and it is these straggling groups that mark the southward movement of the species. Along the immediate north shore of Lake Ontario, however, the movement is westward, the species probably avoiding a direct crossing of the open lake by skirting it by way of Niagara or points further west.

The autumn of 1933 was marked by extraordinary numbers of Blue Jays. Records gathered more or less casually from Prince Edward County, near the east end of Lake Ontario, to the valley of the Credit, near the west end of the lake, are consistent in their estimate of large numbers and the direction of the flight. A complete presentation of the records from September 17 to October 13 for the several districts where observations were made is unnecessary but a few which reflect the status of the species during the autumn of 1933 are here recorded.

On Sunday, September 17, 1933, the late John Townson saw "hundreds and hundreds" of Blue Jays at Carrying Place, Prince Edward County, all moving westward. Mr. Jack Jennings, of Bowmanville, writes under date of October 2, 1933 that "about four hundred Blue Jays flew over in one gigantic scattered flock" at that place a day or so previously. At Toronto, Mr. C. E. Hope observed "eight hundred or more in a loose flock flying west over Cedarvale ravine on September 28, 1933". Many similar observations of Blue Jays were made at Toronto by numerous observers from September 25 to well into October and many inquiries about the species reached the Museum by telephone and letter. Flocks of Blue Jays were also commonly observed in both Peel and Dufferin Counties between September 24 and October 7, 1933.

The past autumn (1934) was not marked by any unusual abundance of Blue Jays. An examination of records of their occurrence at Toronto for several years previous to 1933 does not reveal a flight reaching the proportions of that year. It is obvious that the 1933 autumn migration culminated a peak year in the numbers of Blue Jays.

It is possible that the numerical status of this species, at least in the northern part of its range fluctuates periodically as is the case with several other animal forms in northern latitudes but that the fluctuations are less phenomenal and easily escape record.

A PRELIMINARY LIST OF THE BIRDS OF LINCOLN AND WELLAND COUNTIES

By R. W. SHEPPARD, W. E. HURLBURT and G. H. DICKSON

(*Continued from page* 102)

Bonasa umbellus umbellus (Linnaeus). EASTERN RUFFED GROUSE. — A variety of Ruffed Grouse, supposedly referable to the typical eastern form, but about which there appears to be some doubt, is still managing to maintain a foothold in some of the denser woodlands of Lincoln County. The survival of this species in Lincoln County may, perhaps, be accounted for by its development of an excessive wariness. This handsome bird is, on that account, seldom observed; but it may occasionally be flushed in certain of the ravines which cross the much-travelled Niagara Falls - Hamilton highway. Some years ago, it was seen near Niagara-on-the-Lake, but we have no recent records from this particular locality.

Perdix perdix perdix (Linnaeus). EUROPEAN PARTRIDGE. — Apparently present in the Vineland district since about 1923, for it was first noticed by Mr. Dickson in that year. Mr. N. H. Culp, of Vineland Station, is in possession of two mounted specimens which are stated to have been shot in the immediate vicinity. Several more recent reports of this bird have been received from the Vineland area and it is believed that it nests, in small numbers, in this locality.

Colinus virginianus virginianus (Linnaeus). EASTERN BOB-WHITE. — As far as can be ascertained this quail is now extinct in the Niagara district. There are two mounted birds in the possession of Mr. N. H. Culp, of Vineland Station, which are stated to have been shot near his farm about the year 1907. We understand

that it was last heard in that district about 14 years ago. This species appears on our earliest list of Niagara Falls birds for the year 1913; but, unfortunately, no notes accompanied the record. The generally clean methods of cultivation used in modern fruit farming and the multiplicity of gunners no doubt account for the apparent fate of these birds within the area under discussion. There have been some recent attempts to re-establish this bird, and a few liberated at Vineland Station in the spring of 1935 were heard calling in that locality early in June.

Phasianus colchicus torquatus Gmelin. RING-NECKED PHEASANT. — Notwithstanding the fact that it is subjected to heavy shooting, both legal and illegal, the Pheasant manages to hold its own very well. Apart from gunners, heavy snowfalls apparently give the Pheasant the most trouble but, in this connection, the sloping banks of the Niagara River gorge and certain reedy marshes appear to afford them considerable protection during the winter months. Many farmers appear to be well disposed toward these birds and feed them during hard weather; but others are inclined to complain and accuse them of destructiveness among such crops as tomatoes and grapes. It has been reported from the Vineland area that partially albino examples of this bird are occasionally encountered.

Rallus elegans elegans Audubon. KING RAIL. — We have no information regarding the present status of this rail in the counties under discussion; but there is an old record given by Eaton[22] of a nest with ten eggs of this species being found at Point Abino in Welland County.

Rallus limicola limicola Vieillot. VIRGINIA RAIL. —Our only record of the occurrence of this bird within the district is that of a specimen picked up dead near Vineland on May 19, 1928.

Porzana carolina (Linnaeus). SORA. — A dead specimen of this rail was found near Jordan Pond on October 14, 1929, and an immature bird, with a broken wing, was brought to one of the authors at Vineland on September 8, 1933. We have no other definite record of the occurrence of this bird within the district; but it is easily overlooked, and we should not be surprised if it turned out to be a reasonably common species in suitable localities within both counties.

Gallinula chloropus cachinnans Bangs. FLORIDA GALLINULE. — A bird of this species was found dead near Jordan Pond on May 13, 1932. We do not appear to have any other record of the occurrence of this gallinule.

Fulica americana americana Gmelin. AMERICAN COOT. — The Coot occurs on the Jordan marshes in Lincoln County and is not infrequently seen, during the autumn migration season, on the wide expanse of river below the Falls, at Niagara.

Charadrius melodus Ord. PIPING PLOVER. — The exceedingly interesting discovery of a nest of this species at Sherkston in Welland County, on May 17, 1934, has been recorded by the Buffalo Ornithological Society in their mimeographed journal "The Prothonotary" for March, 1935. There are of course some old and well-known breeding grounds of the Piping Plover at Long Point in Norfolk County, some 50 or 60 miles to the west, but until this recent discovery by ornithologists from Buffalo, it was not suspected to occur as a breeding bird at the eastern end of the Niagara Peninsula.

Charadrius semipalmatus Bonaparte. SEMI-PALMATED PLOVER. — A common bird during the autumn migration period. Almost any day, throughout the month of September, small parties of this plover may be seen, mixing with other waders, on the sandy beaches at Niagara-on-the-Lake, in Lincoln County, and at the southern end of the Niagara River, or along the shores of Lake Erie, in Welland County.

Oxyechus vociferus vociferus (Linnaeus). KILLDEER. — A very common summer bird in both counties. This plover generally arrives soon after the middle of March, and usually all have departed before the middle of October, but occasionally odd birds, or small parties, will linger on until late in November.

Pluvialis dominica dominica (Muller. AMERICAN GOLDEN PLOVER. — One Golden Plover, a very dark bird in almost full summer plumage, was observed at Morgan's Point in Welland County, on September 3, 1932. This particular bird allowed a fairly close approach; while, after being disturbed, it was seen again in close proximity to a Black-bellied Plover, also still in summer plumage, and the striking difference between the two species, when thus seen together, was very apparent.

Squatarola squatarola (Linnaeus). BLACK-BELLIED PLOVER. — Although never seen in large numbers this fine plover is quite common during the autumn migration season. Throughout September and during the first part of October, small parties, consisting of three or four individuals, are quite frequently to be seen along the shores of Lake Erie, in Welland County, or, less commonly, on the mud flats or sandy beaches

22. *Birds N.Y.*, 1: 272, 1910.

at either end of the Niagara River. At the beginning of September, it is not uncommon to see the occasional bird in full or nearly full summer plumage; but, by the end of the month, practically all birds seen are in the light grey winter phase. Laing,[23] at Beamsville, in 1918, observed a flock on August 23rd and one or two odd birds both earlier and later in the same month.

Arenaria interpres morinella (Linnaeus). RUDDY TURNSTONE. — Occurs during both spring and autumn migration periods, but perhaps more commonly in the latter season. Six or more were observed by the senior author on the Lake Erie shore west of Port Colborne on May 23, 1933, two or three a few miles east of the same place on August 10th of that year, and several in the same general vicinity on July 31, 1935. Laing[24] reports seeing one at Beamsville on August 14, 1918.

Philohela minor (Gmelin). AMERICAN WOODCOCK. — Apparently of somewhat rare occurrence within the boundaries of the territory under discussion; but it has been recently observed in Haldimand County and there is every reason to believe that several were seen, during the summers of 1931 and 1932, in the wild swampy woodlands near Warner in Lincoln County, close to the Haldimand border. G. J. Clout of St. Catherines, tells us that he observed a single bird in the Burgoyne Woods near that city on May 21, 1935.

Capella delicata (Ord.) WILSON'S SNIPE. — This cannot be considered a common bird in the district. We have a record of one seen, in cold, snowy weather, on March 28, 1921, feeding in a ditch, in a rough pasture field about two miles from Niagara Falls, and G. J. Clout has informed us of his more recent observation of 6, apparently a family party, flushed from the side of a slough near Burgoyne Woods, St. Catharines, on June 15, 1935.

Phaeopus hudsonicus (Latham). HUDSONIAN CURLEW. — No personal records, but reported as occurring in numbers up to 100 or more along the Welland County shore of Lake Erie and at Niagara Falls between May 25 and June 5, 1935, by members of the Buffalo Ornithological Society. Laing,[25] on the Lake Ontario shore at Beamsville in 1918, records this large wader as passing by in several small flocks between July 31 and September 8.

Bartramia longicauda (Bechstein). UPLAND PLOVER. — Not common, but occurs locally within the area. The senior author saw five, possibly a family party, near Lyon's Creek in Welland County on July 2, 1934, and G. J. Clout has told us of seeing two, probably a pair, between Virgil and McNab, in Lincoln County, on June 2, 1935, and one in the same locality on June 16th. Laing[26] saw a few on passage in August, 1918, and states the species bred locally, near Beamsville, at that time.

Actitis macularia (Linnaeus). SPOTTED SANDPIPER. — A common summer bird throughout the district; perhaps more in evidence along the Niagara River and on the shores of Lake Erie than elsewhere.

Tringa solitaria solitaria Wilson. EASTERN SOLITARY SANDPIPER. — Very seldom observed. Occurs sparingly during spring migration.

Catoptrophorus semipalmatus inornatus. (Brewster). WESTERN WILLET. — No personal records, but there is a recent report by the Buffalo Ornithological Society in their mimeographed journal "The Prothonotary", of the occurrence of a bird of this species at Crystal Beach, in Welland County, on August 23, 1935.

Totanus melanoleucus (Gmelin). GREATER YELLOW-LEGS. — This large wader appears to be somewhat uncommon, but odd individuals are occasionally seen along the Niagara River in company with small parties of Lesser Yellow-legs or other waders. All of our records have been obtained during the autumn migration period, and between the dates August 17th and October 30th.

Totanus flavipes (Gmelin). LESSER YELLOW-LEGS. — From the middle of August until about the end of September, small parties of Lesser Yellow-legs are quite frequently to be met among the congregations of other waders which frequent certain favoured spots along the shores of Lake Erie, in Welland County; while, at times, this species is quite plentiful along the banks of the Niagara River, where it occasionally lingers until late in October.

Calidris canutus rufus (Wilson). AMERICAN KNOT. — Small parties of Knots have been observed in Welland County on two or three separate occasions during recent years. A small flock of about half a dozen were seen on the lake shore at Morgan's Point on September 3, 1932, and three others at the same place on September 10th. The smaller party, very grey

23. *Can. Field-Nat.* 34: 22, 1920.
24. *Idem.*
25. *Idem.*
26. *Idem.*

birds, appeared to be somewhat sluggish or reluctant in fly and allowed a very close approach. Another small group, containing three individuals, was observed on the bank of the Niagara River, near old Fort Erie, on September 16, 1933.

Pisobia melanotos (Vieillot). PECTORAL SANDPIPER. — One or two individuals of this species are occasionally observed, in company with other waders, during the autumn migration season. Three were seen at Morgan's Point, in Welland County, between September 10 and 24, 1932, one on the banks of the Niagara River, south of Fort Erie, on September 16, 1933, and another one in the same location on August 23, 1934. We believe that we saw a small flock of these sandpipers on the sandy beach near the old fort at Niagara-on-the-Lake, in Lincoln County, on October 8, 1932; but, owing to the fact that illegal shooting was going on at the time, and that they were very wild, a close approach and definite identification were impossible.

Pisobia fuscicollis (Vieillot). WHITE-RUMPED SANDPIPER. — Two were observed, in company with a flock of Least and Semipalmated Sandpipers, on the Niagara River mud flats, near old Fort Erie, on August 31, 1933. This appears to be one of the rarer of the small Sandpipers occurring in the Niagara district during the autumn migration period.

Pisobia bairdi (Coues). BAIRD'S SANDPIPER.— A small party of four of these sandpipers was seen and very closely observed at Morgan's Point on September 3, 1932. One was seen on the beach at Port Colborne on May 23, 1933, and one on the Niagara River bank near Fort Erie on September 16, 1933. Although we have only these few definite observations to record, we have reason to believe that this species is apt to occur sparingly but more or less regularly, on the shores of Lake Erie, in Welland County, during the latter part of August and early September.

Pisobia minutilla (Vieillot). LEAST SANDPIPER. —Probably the commonest of the waders on the shores of Lake Erie during the early autumn migration. At this time, practically every concourse of shore birds has its quota of "Peeps" and a large proportion of these is undoubtedly referable to this species.

Pelidna alpina sakhalina (Vieillot). RED-BACKED SANDPIPER. — Apparently of somewhat rare occurrence. A party of six, in full breeding plumage, was observed by the senior author, on the lake shore near Port Colborne, on May 23, 1933, and three in the grey plumage of winter were seen on the beach at Niagara-on-the-Lake, on October 25, 1934. An individual of this species, with a broken wing, was picked up at Vineland on October 29, 1929, and later sent to the Royal Ontario Museum of Zoology for preservation.

Limnodromus griseus griseus (Gmelin). EASTERN DOWITCHER. — Undoubtedly one of the rarer of the waders occurring in this district. Two were observed, in company with a Knot and a Lesser Yellow-legs, on the banks of the Niagara River, near the old Fort Erie, on August 25, 1933. Near the Peace bridge, on September 2, 1933, another Dowitcher, a large dark bird with an astonishingly long bill, was watched for some considerable time, at a very close range, as it diligently probed in the mud in company with a Stilt Sandpiper.

Micropalama himantopus (Bonaparte). STILT SANDPIPER. — Of rare occurrence, or at least very seldom observed. A long-legged Sandpiper, believed to be referable to this species, was seen in company with about half-a-dozen other species of waders, at Morgan's Point in Welland County, on August 27, 1932. Another bird identified beyond any possible doubt, was observed, in close company with a Dowitcher, near the Peace bridge at Fort Erie, on September 2, 1933. The Stilt Sandpiper and the Dowitcher were closely watched, probing in the mud side by side, at a distance of only 6 or 8 paces.

Ereunetes pusillus (Linnaeus). SEMIPALMATED SANDPIPER. — "Peeps" of both species are common on the shores of Lake Erie, in Welland County, during the autumn migration; but, whereas the Least Sandpiper is probably the commonest wader during the latter part of August and early September, this slightly larger, semipalmated bird would appear to make a bid for this distinction before the season has advanced very far into the latter month. On September 3, 1932, at Morgan's Point, Welland County, an unusual-looking "Peep" was closely observed through field glasses at a distance of only a few yards; the larger size, longer legs, and longer bill with the suspicion of a downward curve to the tip, made us wonder whether the bird could possibly be a western *E. maurii*. Other unusual looking "Peeps", seen from time to time have inclined us toward the belief that *Ereunetes maurii* may possibly occur on the Great Lakes, during the autumn migration, more frequently than is supposed; but it is, of course, realized that only careful and systematic collecting could settle such a point.

Limosa haemastica (Linnaeus). HUDSONIAN GODWIT. — The apparent rareness of this large

wader in southern Ontario makes doubly interesting a report by the Buffalo Ornithological Society of the occurrence of the Hudsonian Godwit at Point Abino in Welland County on May 28, 1934.

(To be continued)

HYDROID DISTRIBUTION IN THE VICINITY OF THE QUEEN CHARLOTTE ISLANDS

By C. McLEAN FRASER

THE MARINE fauna of the Queen Charlotte island region, apparently a rich one, has received very little attention. Information on the hydroid fauna has been very meagre. Occasional specimens have been collected, usually with no report as to exact location, and a label with "Queen Charlotte islands" on it, does not help very much in such a large area. Thirty species in all had been reported previous to 1935.

During the summer of 1935, the Canadian Hydrographic Service, under the command of Mr. H. D. Parizeau, was engaged in making a survey of the southern and western coasts of these islands. Through the courtesy of the Service, in co-operation with the Biological Board of Canada, an opportunity was afforded to spend two months with the C. G. S. *Wm. J. Stewart*, to make marine biological collections, with a watchful eye for hydroids.

During these two months, June and July, nearly all the shingly beaches, in and around Houston Stewart Channel, the west coast of Moresby Island and Skidegate Channel, were examined for zoological specimens. While numerous species were represented, there were few hydroids among them.

The rocks at the mouths of bays, and those directly exposed to the Pacific, were seldom workable at low spring tides, but still they were visited in three localities under quite favourable conditions. These three were: Danger rocks, near the eastern entrance of Houston Stewart Channel, rocky islets and reefs at the entrance to Flamingo Harbour and at the entrance to Big Bay. In each case, the hydroids were present in great masses but the number of species was not very great, fourteen at Danger rocks being the maximum.

A little dredging in Tasoo Harbour and in Rennell Sound (Graham Island) produced comparatively little. All the large inlets on the west coast of Moresby Island and Graham Island are in the nature of fiords, deep, with steep shores and muddy bottom, but usually with a definite threshold. They are not biologically promising except near the entrance.

Seaward from the main shore, the sea-bottom, like the land surface near by, is extremely rugged, especially in the vicinity of Tasoo Harbour. On that account, weather and sea conditions must be very favourable to make it advisable to try dredging along most of the coast. A couple of attempts did little more than indicate how rich a fauna might be expected.

In the somewhat sheltered waters of Houston Stewart channel, where good dredging ground can be obtained at no great depth, a better picture is presented. In four dredge hauls, made in 15-18 fathoms, near the middle of the channel, about two miles east of Flat rock, at the western entrance of the channel, 47 species of hydroids were obtained.

During August and early September, under the direction of Mr. Parizeau, some dredging was done off Rose Harbour, in Houston Stewart Channel, in Massett Harbour, off Massett Inlet in Dixon Entrance and West of Rose Spit. The material obtained contained a good supply of hydroids.

It may be that since several spots were touched over a wide area, extending from the farthest south, along the west and north coasts, that the hydroid collection from shore and shallow water, is quite representative of the hydroid fauna of these coasts, even if it is very incomplete.

All of the species previously reported from the islands, except three, *Obelia borealis, Halecium parvulum* and *Selaginopsis pinnata,* appeared in the collection.

A report on nine of the species obtained, — three new, one with the gonangium new and five new to the Pacific coast of North America, has already been published (Jour. Biol. Board Can. 1 (6), 1936).

The synonymy of almost all of the others has appeared in various papers on west coast hydroids (more particularly in "The Hydroids of the West Coast of North America", Bull. Lab. Nat. Hist., State Univ. of Iowa, 1911, and in "Hydroids of the Vancouver Island Region", Trans. Roy. Soc. Can. (3) 8, Sec. 4, 1914). It seems unnecessary to repeat this, consequently, the discussion is limited to the distribution of all of the species

of the region, obtained in 1935, or reported before that date. Of the previous records, reference is made only to those in which a definite location is given.

SPECIES AND DISTRIBUTION

Family CLAVIDAE

Tubiclava cornucopiae Norman. — Outside Massett harbour; 15 fathoms.

Turris neglecta (?) Lesson. — On north shore of Hibben island as it faces Inskip channel, on the carapace of a crab, *Pugettia gracilis*, low tide.

Family LARIDAE

Monobrachium parasitum Mereschkowsky. — In Rennell sound, between Gospel island and the south shore, 60-70 f.

Family CORYNIDAE

Syncoryne mirabilis (Agassiz). — In the western Skidegate narrows, low tide.

Family ATRACTYLIDAE

Bineria gracilis Clark. — Entrance to Southwest arm and west of Horn island, Tasoo Harbour, 10-25 f.; in tow net near surface at ebb tide, western end of Houston Stewart channel; eastern end of Houston Stewart channel, off Rose harbour, 30 f.

Garveia annulata Nutting. — North of Marble island, 60 f.; west of Horn island, Tasoo harbour, 7-25 f.; on rock near entrance to Flamingo harbour, low tide; in tow net, near surface, at ebb tide, western entrance to Houston Stewart channel; Houston Stewart channel, off Rose harbour, 30 f.; in tow net, near surface, ½ mile west of cape St. James; Massett harbour, 13 f.

Garveia groenlandica Levinsen. — Houston Stewart channel, off Rose harbour, 30 f., Massett harbour, 13 f.

Perigonimus repens (Wright). — Houston Stewart channel, off Rose harbour, 30 f.; west of Rose Spit, 16 f.

Perigonimus serpens Hincks. — In Rennell sound, between Gospel island and the south shore, 60-70 f.; near the north shore of Tasoo harbour, 7-14 f.; west of Rose Spit, 16 f.

Family EUDENDRIDAE

Eudendrium rameum (Pallas). — In western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Eudendrium tenellum Allman. — In tow net, near surface, at ebb tide, western portion of Houston Stewart channel.

Eudendrium vaginatum Allman. — On Danger rocks, near eastern entrance of Houston Stewart channel, low tide.

Family HYDRACTINIDAE

Hydractinia aggregata Fraser. — Entrance to southwest arm, Tasoo harbour, 10-25 f.; west of Rose Spit, 16 f.

Family TUBULARIDAE

Tubularia aurea Fraser. — On Danger rocks, near the eastern entrance of Houston Stewart channel, low tide; on molluscs adhering to floating *Macrocystis*, Flamingo harbour.

Tubularia crocea (Agassiz). — In tow net, near surface, at ebb tide, western portion of Houston Stewart channel; in the same location in 15-18 f.

Family CAMPANULARIDAE

Campanularia gelatinosa (Pallas).—In western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.

?*Campanularia gigantea* Hincks. — 9½ miles south of Marble island, 190 f.

Campanularia groenlandica Levinsen. — Off Cape Edenshaw (Fraser); in tow net, near surface, at ebb tide, western portion of Houston Stewart channel; in the same location in 15-18 f.; Massett harbour, 13 f.

Campanularia integra (MacGillivray). — On rock near entrance to Flamingo harbour, low tide; in tow net, near surface, at ebb tide, western portion of Houston Stewart channel; in same location in 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Campanularia raridentata (Alder). — Houston Stewart channel, off Rose harbour, 30 f.; off Massett inlet, 15 f.

Campanularia speciosa Clark. — Off Massett (Fraser); in tow net, near surface, at ebb tide, in western portion of Houston Stewart channel; in same location in 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Campanularia urceolata Clark. — Distributed though the whole area in which collections were made.

Campanularia verticillata (Linn.). — Off Rose Spit (Fraser); 9½ miles south of Marble island, 190 f.; western portion of Houston Stewart channel, 15-18 f.

Campanularia volubilis (Linn.). — Massett harbour, 13 f.

Clytia cylindrica Agassiz. — Western Skidegate narrows, low tide; Houston Stewart channel, off Rose harbour, 30 f.

Clytia edwardsi (Nutting). — South shore of Big bay, low tide; entrance to southwest arm, Tasoo harbour, 10-25 f; on floating *Macrocystis*, Flamingo harbour; in tow net,

near surface, at ebb tide, western portion of Houston Stewart channel; in same location in 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; outside Massett harbour, 15 f.

Clytia johnstoni (Alder). — Houston Stewart channel, off Rose harbour, 30 f.

Clytia kincaidi (Nutting). — Rennell sound, between Gospel island and south shore, 60-70 f.; Houston Stewart channel, off Rose harbour, 30 f.

Clytia minuta (Nutting). — In tow net, near surface, at ebb tide, western portion of Houston Stewart channel.

Eucopella caliculata (Hincks). — Off Massett (Fraser); on rocks at the entrance to Big bay, low tide.

Eucopella everta (Clark). — Danger rocks, near eastern entrance to Houston Stewart channel, low tide; rock at entrance to Flamingo harbour, low tide; in tow net, near surface, at ebb tide, western portion of Houston Stewart channel; Massett harbour, 13 f.

Gonothyraea clarki (Marktanner-Turneretscher). — West of Horn island, Tasoo harbour, 7-25 f.; western and eastern narrows, Skidegate channel, low tide; in tow net, near surface, at ebb tide, western portion of Houston Stewart channel; in the same location in 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.

Gonothyraea gracilis (Sars). — North of Marble island, 60 f.; Rennell sound, northwest of Gospel island and south of Gospel island, 60-70 f.

Gonothyraea inornata Nutting. — North shore of Hibben island, Inskip channel, low tide; rock at entrance to Flamingo harbour, low tide; rocks at entrance to Big bay, low tide; in tow net, near surface, at ebb tide, western portion of Houston Stewart channel; Houston Stewart channel, off Rose harbour, 30 f.

Obelia borealis Nutting. — Off Massett (Fraser).

Obelia dichotoma (Linn.). — Western Skidegate narrows, low tide; on floating *Nereocystis*, Flamingo harbour; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.

Obelia dubia Nutting. — Western portion of Houston Stewart channel, 15-18 f.; west of Rose Spit, 16 f.

Obelia geniculata (Linn.). — Houston Stewart channel, off Rose harbour, 30 f.

Obelia longissima (Pallas). — Nearly everywhere in the area, on rocks, ashore, on floating seaweed, sticks, etc., as well as in dredged material at moderate depths.

Obelia plicata Hincks. — Western end of eastern Skidegate narrows, low tide; western portion of Houston Stewart channel, 15-18 f.

Family CAMPANULINIDAE

Calycella syringa (Linn.). — On other hydroids, worm tubes, etc., in all areas and at all depths in which dredging was done.

Cuspidella grandis Hincks. — Off Rose spit (Fraser); Rennell sound, between Gospel island and the south shore, 60-70 f.

Cuspidella humilis (Alder). — West of Rose Spit, 16 f.

Egmundella gracilis Stechow. — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Family HALECIDAE

Halecium annulatum Torrey. — Rock at entrance to Flamingo harbour, low tide; in tow net, near surface, at ebb tide, western portion of Houston Stewart channel; in tow net, ½ mile west of cape St. James; Massett harbour, 13 f.

Halecium articulosum Clark. — Houston Stewart channel, off Rose harbour, 30 f.

Halecium corrugatum Nutting. — Rennell sound, northwest of Gospel island, 60 f.; rock near entrance to Flamingo harbour, low tide; western portion of Houston Stewart channell, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.; outside of Massett inlet, 15 f.

Halecium densum Calkins. — Off Massett, off Rose Spit (Fraser); Houston Stewart channel, off Rose harbour, 30 f.

Halecium labrosum Alder. — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Halecium parvulum Bale. — Off Rose Spit (Fraser).

Halecium pygmaeum Fraser. — In tow net, near surface, at ebb tide, western portion of Houston Stewart channel.

Halecium tenellum Hincks. — Off Rose Spit (Fraser); north of Marble island, 60 f.; on Danger rocks, near eastern entrance of Houston Stewart channel, low tide; rock, near entrance to Flamingo harbour, low tide; in tow net, near surface, at ebb tide, western portion of Houston Stewart channel; in the same location in 15-18 fathoms; Houston Stewart channel, off Rose harbour, 30 f.

Halecium washingtoni Nutting. — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Halecium wilsoni Calkins. — In tow net, near surface, at ebb tide, western portion of Houston Stewart channel; in same location in 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; outside Massett inlet, 15 f.

Ophiodes corrugata Fraser. — Houston Stewart channel, off Rose harbour, 30 f.

Ophiodes gracilis Fraser. — In tow net, near surface, ebb tide, western portion of Houston Stewart channel.

Family LAFOEIDAE

Filellum serpens (Hassell). — Rock near the entrance of Flamingo harbour, low tide; western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Grammaria immersa Nutting. — Western portion of Houston Stewart channel, 15-18 f.

Lafoea dumosa (Fleming). — Rock at entrance to Flamingo harbour, low tide; western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.; outside Massett harbour, 15 f.

Lafoea fruticosa Sars. — North of Marble island, 60 f.

Lafoea gracillima (Alder). — North of Marble island, 60 f.; west of Horn island, Tasoo harbour, 7-25 f.; in tow net, near surface, ebb tide, western portion of Houston Stewart channel; in same location in 15-18 f.; Massett harbour, 13 f.; outside Massett inlet, 15 f.

Family SERTULARIDAE

Abietinaria abietina (Linn.). — Off cape Edenshaw, off Massett (Fraser); western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.

Abietinaria amphora Nutting. — Danger rocks, near eastern entrance to Houston Stewart channel, low tide; Flat rock, Houston Stewart channel, low tide; western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; rock at entrance to Big bay, low tide.

Abietinaria anguina (Trask). — Danger rocks, near eastern entrance to Houston Stewart channel, low tide; rock near entrance to Flamingo harbour, low tide; in tow net, near surface, ebb tide, western portion of Houston Stewart channel; in same location in 15-18 f.; Massett harbour, 13 f.

Abietinaria costata (Nutting). — Danger rocks, near eastern entrance to Houston Stewart channel, low tide.

Abietinaria filicula (E. & S.). — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Abietinaria gigantea (Clark). — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Abietinaria greenei (Murray). — Danger rocks, near eastern entrance to Houston Stewart channel, low tide; Flat rock, Houston Stewart channel, low tide; western portion of Houston Stewart channel, 15-18 f.; rock at entrance to Flamingo harbour, low tide; rocks at entrance to Big bay, low tide; Massett harbour, 13 f.

Abietinaria rigida Fraser. — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Abietinaria turgida (Clark). — Danger rocks, near eastern entrance to Houston Stewart channel, low tide; rock at entrance to Flamingo harbour, low tide; rocks near entrance to Big bay, low tide; in tow net, near surface, ebb tide, western portion of Houston Stewart channel; in same location, 15-18 f.; outside Massett inlet, 15 f.

Abietinaria variabilis (Clark). — Off cape Edenshaw, off Massett, off Rose Spit (Fraser); western portion of Houston Stewart channel, 15-18 f.

Hydrallmania distans Nutting. — Off Rose Spit (Fraser); western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; outside Massett inlet, 15 f.

Selaginopsis cylindrica (Clark). — Off cape Edenshaw, off Massett, off Rose Spit (Fraser); western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f,; Massett harbour, 13 f.; outside of Massett inlet, 15 f.

Selaginopsis mirabilis (Verill). — Off Massett (Fraser); outside Massett inlet, 15 f.

Selaginopsis pinnata Mereschkowsky. — Off Rose Spit (Fraser).

Selaginopsis trilateralis Fraser. — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Sertularella albida Kirchenpauer. — Western portion of Houston Stewart channel, 15-18 f.

Sertularella conica Allman. — East shore of Flamingo harbour, low tide; Danger rocks, near eastern entrance to Houston Stewart channel, low tide; western portion of Houston Stewart channel, 15-18 f.

Sertularella pinnata (Clark). — Massett harbour, 13 f.

Sertularella polyzonias (Linn.). — Massett harbour, 13 f.

Sertularella rugosa (Linn.). — Rock at entrance to Flamingo harbour, low tide; Houston Stewart channel, off Rose harbour, 30 f; Massett harbour, 13 f.

Sertularella tanneri Nutting. — Massett harbour, 13 f.

Sertularella tenella (Alder). — Off Massett (Fraser); in tow net, near surface, ebb tide, western portion of Houston Stewart channel; in same location, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.

Sertularella tricuspidata (Alder). — In tow net, near surface, ebb tide, western portion, Houston Stewart channel; in same location, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.; outside Massett inlet, 15 f.

Sertularella turgida (Trask). — North of Marble island, 60 f.; Rennell sound, northwest of Gospel island, 60 f.; rock at entrance to Big bay, low tide; rock at entrance to Flamingo harbour, low tide; Danger rocks, near eastern entrance to Houston Stewart channel, low tide; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.

Sertularia furcata Trask. — North shore of Big bay, low tide.

Thuiaria alba Fraser. — Houston Stewart channel, off Rose harbour, 30 f.

Thuiaria argentea (Linn.). — In tow net, near surface, flood tide, western portion Houston Stewart channel; in same location, 15-18 f.; outside Massett inlet, 15 f.

Thuiaria dalli Nutting. — Off Rose Spit, Naden harbour, cape Edenshaw (Fraser); western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.; outside Massett inlet, 15 f.

Thuiara distans Fraser. — 9½ miles south of Marble island, 190 f.

Thuiaria fabricii (Levinsen). — Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Thuiaria similis (Clark). — Off Rose Spit (Fraser); Western portion of Houston Stewart channel, 15-18 f.; Houston Stewart channel, off Rose harbour, 30 f.

Thuiaria thuiarioides (Clark). — Rose Spit (Fraser); Houston Stewart channel, off Rose harbour, 30 f.; Massett harbour, 13 f.; off Massett inlet, 15 f.

Family PLUMULARIDAE

Aglaophenia latirostris Nutting. — Massett harbour, 13 f.

Aglaophenia struthionides (Murray). — Danger rocks, at eastern entrance to Houston Stewart channel, low tide; western portion of Houston Stewart channel, 15-18 f.; rock at entrance to Flamingo harbour, low tide; rocks at entrance to Big bay, low tide; Rennell sound, northwest of Gospel island, 60 f.; Massett harbour, 13 f.; outside Massett inlet, 15 f.

Plumularia lagenifera Allman. — Off Massett (Fraser); rock at entrance to Flamingo harbour, low tide; rocks at entrance to Big bay, low tide; in tow net, near surface, ebb tide, western portion of Houston Stewart channel; in same location, 15-18 f.; Massett harbour, 13 f.; outside Massett inlet, 15 f.; in tow net, near surface, ½ mile west of cape St. James; Houston Stewart channel, off Rose harbour, 30 f.

Plumularia setacea (Ellis). — In tow net, near surface, ebb tide, western portion of Houston Stewart channel.

Submitted for publication.

Feb. 29, 1936.

BRYANT WALKER 1856-1936.

The science of malacology lost a brilliant worker by the death on May 26 of Dr. Bryant Walker of Detroit. Dr. Walker had been in ill health for seven years but previously had been active for some fifty years in the study of shells. He had accumulated a large private collection containing many types, many of them of Canadian species.

Doctor Walker was a prolific writer, many of his articles appearing in the *The Canadian Field-Naturalist*. His training as a lawyer gave his works an ordered and logical form which reflected the painstaking research behind them. It is hoped that a more complete account of Dr. Walker's life will appear in an early number of the Naturalist. —EDITOR.

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*POST-PLEISTOCENE FOSSILS OF THE UPLIFTED BEACHES OF THE EASTERN ARCTIC REGIONS OF CANADA.**

By D. A. NICHOLS

Bureau of Economic Geology. Department of Mines, Ottawa, Canada

RAISED strand-lines as shown by terraces, beach ridges and other marine land forms are found in numerous places along the mainland of Canada and on the islands of the Arctic Archipelago.

The chief interest in the terraces and beaches lies in the information they may afford regarding the amount and character of the post-glacial movements of the land. It is often difficult to recognize some of the higher beaches in the Arctic regions, as they have been exposed to sub-aerial erosion for a long time. They are frequently disguised by solifluction, which is so active in the areas of permanently frozen ground.

Investigations made for the Department of Mines during the season 1935, while with the Eastern Arctic Expedition, sponsored by the Lands, Northwest Territories and Yukon Branch, Department of the Interior, Ottawa, Canada, indicate that foraminifera may be used to determine marine beaches and terraces when other criteria are obscure or lacking.

In the areas examined, foraminifera were found in indefinite beach-solifluction forms up to an elevation of 548 feet above mean sea-level, in many places where the macroscopic shells were not obtained. In every clay-sand sample collected, except two, foraminifera were present. Sufficient information has not been obtained to state how much higher, if any, these fossils may be found. Further investigation along these lines may extend their vertical range, and may also throw some light on the character of the obscure Pleistocene deposits reported in a few places on the coasts of the Western Arctic and on Baffin and Southampton Islands, where, apparently, Pleistocene material forms the summits of hills as high as 1300 feet above sea-level (1,2).

If these high deposits are marine, as suggested, the amount of post-glacial emergence is over 1300 feet, in places. Such obscure deposits as these mentioned, and small clay pockets on side hills and summits at elevations beyond the highest recognizable marine beach, might well be examined for these microscopic shells to afford a clue to determine the character of the deposits and provide further information regarding the highest recognizable stand of the water at the end of Pleistocene submergence.

The fact must not be overlooked, however, that some of the foraminiferal clays may have been glacially transported, but in most of the localites examined, their position and the direction of glacial movement made this appear improbable.

A list of the macro-fossils and of the foraminifera collected from the various localities and their elevations is annexed.

Macro-fossils indentified by A. La Rocque, Palaeontological Division, Geological Survey, Ottawa, Canada.

SUGLUK, QUEBEC. — Elevation 224 feet.
Cardium ciliatum O. Fabr.
Mya arenaria (Linn.)
Mya truncata uddevalensis (Forbes)
Saxicava arctica (Linn.)
Macoma calcarea Gmelin
Pecten islandicus var.
Trichotropis borealis Brod. & Sowerby
Barnacle plates.

ERIC COVE, WOLSTENHOLME, QUE. — Elevation 345 feet.
Saxicava arctica (Linn.)
Mya truncata uddevalensis (Forbes)
Macoma calcarea Gmelin
Pecten islandicus fragment.

ERIC COVE, WOLSTENHOLME, QUE. — Elevation 233 feet.
Astarte cf. *banksii* (Leach) worn
Serripes groenlandicus (Brugière)

*Published with the permission of the Director, Bureau of Economic Geology, Department of Mines, Ottawa, Ontario.

Mya truncata uddevalensis (Forbes)
Macoma calcarea (Gmelin)
Saxicava arctica (Linn.).

BEAR COVE, WOLSTENHOLME, QUE. — Elevation 365 feet.
Mya truncata uddevalensis (Forbes)
Saxicava arctica (Linn.)
Macoma calcarea (Gmelin)
Pecten islandicus (Müller) fragment.

DUNDAS HARBOUR, DEVON ISLAND. — Elevation 145 feet.
Littorina sp. (young cf. *L. groenlandica* (Mencke.).)

WAKEHAM BAY, QUEBEC. — Elevation 110 feet.
Mya arenaria (Linn.)
Cardium ciliatum (O. Fabr.).

PORT HARRISON, QUEBEC. — Elevation 10 to 94 feet.
Buccinum sp. worn
Mya arenaria (Linn.)
Astarte elliptica Brown
Mya truncata uddevalensis (Forbes)
Astarte borealis Schumacher
Serripes groenlandicus (Bruguière)
Saxicava arctica (Linn.)
Pecten islandicus islandicus (Müller)
Pecten islandicus insculptus Verrill
Pecten islandicus worn valves
Cardium ciliatum (O. Fabr.) smooth-ribbed form.

PORT HARRISON, QUEBEC. Locality No. 2. — Elevation 20 to 42 feet.
Pecten islandicus insculptus Verrill
Cardium ciliatum (O. Fabr.)
Serripes groenlandicus (Bruguière)
Mya arenaria (Linn.)
Mya truncata uddevalensis (Forbes)
Saxicava arctica (Linn.)
Astarte ?borealis worn specimen.

PORT HARRISON, QUEBEC. — Elevation 124 feet.
Cardium ciliatum (O. Fabr.)
Serripes groenlandicus (Brugière)
Pecten islandicus (Müller) worn
Pecten islandicus insculptus Verrill
Mya arenaria (Linn.).

PORT HARRISON, QUEBEC. About one mile south. — Elevation 162 feet.
Cardium ciliatum (O. Fabr.) smooth-ribbed form
Mya truncata uddevalensis (Forbes)
Mytilus edulis (Linn.)
Saxicava arctica (Linn.)
Buccinum sp. fragments
Barnacle plates.

CHURCHILL, MANITOBA. Sand pit, five miles south on railway spur. — Elevation near B.M. 79 feet.
Mya truncata uddevalensis (Forbes)
Cardium ciliatum (O. Fabr.)
Saxicava arctica (Linn.)
Astarte borealis Schumacher
Astarte banksii (Leach)
Macoma balthica (Linn.)
Macoma calcarea (Gmelin)
Nuculana pernula (Müller)
Hemithyris psittacea (Gmelin)
Mytilus edulis (Linn.)
Pecten islandicus insculptus Verrill
Lepeta caeca (Müller)
Pecten islandicus islandicus (Müller)
Barnacle plates.

CHURCHILL, MANITOBA. About fifty miles inland. H. B. Ry. Miles 350, 396. — Elevation 450 feet.
Saxicava arctica (Linn.)
Collected by Major J. L. Charles. Two Walrus skulls were found here also.

CORAL HARBOUR, SOUTHAMPTON IS. About three miles inland. — Elevation 134 feet.
Lepeta caeca (Müller)
Astarte banksii (Leach)
Saxicava arctica (Linn.).

CRAIG HARBOUR, ELLESMERE ISLAND. — Elevation about 10 feet.
Astarte borealis Schumacher
Astarte banksii (Leach)
Saxicava arctica (Linn.)

FOND'S INLET, BAFFIN ISLAND. — Elevation 65 to 120 feet.
Astarte borealis Schumacher
Saxicava arctica (Linn.)
Mya truncata uddevalensis (Forbes)
Buccinum sp.
Mytilus edulis (Linn.) shore form.

PANGNIRTUNG, BAFFIN ISLAND. — Elevation sea level to about 10 feet.
Astarte borealis Schumacher
Astarte cf. *crenata* (Gray) worn
Astarte sp. much worn
Mya truncata uddevalensis (Forbes)
Saxicava arctica (Linn.).

Foraminifera collected from the raised beaches of the Eastern Arctic and Hudson Bay region. (Identified by R. T. D. Wickenden, Geological Survey, Ottawa, Canada).

The clay and sand samples were washed and dried, then passed through 100 and 150 mesh sieves and the fines and intermediates treated

with carbon tetrachloride on which the foraminifera floated. These were filtered off and examined under the microscope.

PORT BURWELL, QUEBEC. — Elevation, 252 feet.
Nonion orbicularis (Brady)
Nonion stelligera (d'Orbigny)
Cassidulina crassa d'Orbigny
Cassidulina laevigata d'Orbigny
Globigerina?

SUGLUK, QUEBEC. — Elevation 224 feet.
Nonion orbicularis (Brady)
Nonion sp.
Cassidulina crassa d'Orbigny
Cassidulina crassa d'Orbigny
Guttulina sp? One specimen

WOLSTENHOLME, QUEBEC. — Elevation 548 feet.
Nonion depressula? (Walker and Jacobs.)
Cassidulina crassa d'Orbigny
Virgulina sp?
Fragment of arenaceous species.

PORT HARRISON, QUEBEC. — Elevation 200 feet.
Nonion orbicularis (Brady)
Elphidium incertum (Williamson).

CHURCHILL, MANITOBA. — Elevation, 80 feet.
Lenticulina sp?
Lagena sp.
Guttulina dawsoni Cushman and Ozawa.
Nonion orbicularis (Brady)
Nonion depressula (Walker and Jacobs)
Elphidium bartleti Cushman.
Elphidium sp?
Cassidulina crassa d'Orbigny
Cassidulina laevigata d'Orbigny
Cibicides lobatulus (Walker and Jacobs).

SOUTHAMPTON ISLAND. — Elevation, 134 feet.
Nonion orbicularis (Brady)
Nonion labradoricum (Dawson)
Elphidium arcticum Parker and Jones.
Cassidulina laevigata d'Orbigny
Cibicides lobatulus (Walker and Jacobs).

SOUTHAMPTON ISLAND. — Elevation 37 feet.
Nonion orbicularis (Brady)
Nonion depressula (Walker and Jacobs)
Buliminella elegantissima? (d'Orbigny)
Cassidulina crassa d'Orbigny
Cibicides lobatulus (Walker and Jacobs).

LAKE HARBOUR, BAFFIN IS.—Elevation 449? feet.
Nonion orbicularis (Brady)
Nonion labradoricum (Dawson)
Elphidium sp?
Cassidulina laevigata d'Orbigny.

POND'S INLET, BAFFIN IS. — Elevation 157 feet.
Nonion orbicularis (Brady)
Nonion sp?
Nonion labradoricum (Dawson)
Cassidulina crassa d'Orbigny
Cassidulina laevigata d'Orbigny
Lagena sp. One specimen
Guttulina sp. One specimen.

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(2) Contributions to the Geography of Baffin Land and Melville Peninsula. *Report of the Fifth Thule Expedition*, 1921-24. Vol 1, No. 3, pp. 47, 96. Therkel Mathiassen.

THE LATE NORMAN CRIDDLE'S RECORD OF THE SNOWSHOE RABBIT (Lepus americanus) AT AWEME, MANITOBA

By HOYES LLOYD

AT THE REQUEST of the writer the late Norman Criddle prepared from his note-books a table of abundance and scarcity of the snowshoe rabbit at Aweme, Manitoba. At this date it is not known that the late Mr. Criddle considered these data sufficiently accurate for publication, but the author takes the responsibility of adding this to Mr. Criddle's published data on this subject.

Following the receipt of the bare record itself he was asked to prepare a curve showing these data, and this he did and wrote on it, "This is about how I would interpret the notes".

Mr. Stuart Criddle tells me that evidently his brother, the late Norman Criddle, because of poor health kept no record of the fluctuation in the snowshoe rabbit during the years 1913 and 1914. The rabbits reached the peak of their abundance during those years, it is stated by Mr. Stuart Criddle, and if the graph showed this fluctuation, it would have followed closely the dotted line.

Mr. Norman Criddle's notes run from 1895 to 1929 inclusive, but at the suggestion of Mr. Stuart Criddle, the notes of the late Norman Criddle are given to 1923 only. Mr. Stuart

Criddle started a special study of the rabbit that year and Norman Criddle helped him.

It is believed that the only use to which these original data of the late Mr. Criddle have been put so far was that they were utilized in a measure in an article by Dr. R. E. DeLury, Assistant Director, Dominion Observatory, Ottawa, entitled "Sunspots and Forest Life" in *Forest and Outdoors,* June, 1931. Dr. DeLury advises the writer that it would be impossible to derive the original data from this article, and therefore he concurs with the writer's view that it is desirable to publish this rabbit record for Aweme, Manitoba.

The table prepared by Mr. Criddle is given below:

"1895—Plentiful.
1896—Rather rare.
1897—Fairly plentiful.
1899—Rather scarce.
1900—Increasing.
1901—Plentiful.
1902—Plentiful.
1903—Still increasing.
1904—Abundant.
1905—Very abundant.
1906—Attacked by tape worms — decreasing.
1907—Decreasing.
1908—About half as numerous.
1912—Fairly plentiful.
1913—Abundant.
1914—Abundant.
1916—Fairly plentiful.
1918—Scarce — Rare.
1919—Increasing.
1920—Very plentiful.
1921—Abundant.
1922—Slightly decreased.
1923—Moderately numerous."

He interpreted these facts as shown on the accompanying chart (solid line), but his brother Stuart Criddle made the change indicated by the dotted line.

Norman Criddle's record of rabbit population at Aweme, Manitoba.

A PRELIMINARY LIST OF THE BIRDS OF LINCOLN AND WELLAND COUNTIES

By R. W. SHEPPARD, W. E. HURLBURT and G. H. DICKSON

(*Continued from page* 122)

Crocethia alba (Pallas). SANDERLING. — Occurs fairly commonly during the autumn migration period, when odd individuals or small flocks are frequently to be seen on the sandy beaches at Niagara-on-the-Lake, on the rock-like mud flats at the southern end of the Niagara River, and at various points along the Lake Erie shore line of Welland County. An early account by the Rev. J. Hibbert Langille[27] of waders at Fort Erie would indicate that Sanderlings were of very frequent occurrence at that point fifty years ago.

Phalaropus fulicarius (Linnaeus). RED PHALAROPE. — A bird of this species has been recorded by the Buffalo Ornithological Society as occurring at Erie Beach in Welland County on October 6, 1935. We know of no other record of occurrence within the area under discussion.

Catharacta skua (Brunnich). NORTHERN SKUA. — The late Otomar Reinecke[28] records an adult Skua which was picked up in the Niagara River gorge and brought to him by friends on December 3, 1915. There have been other reports of Skuas on the Niagara River, but the record quoted is probably the only one that can be safely assigned to the Canadian side.

Larus hyperboreus Gunnerus. GLAUCOUS GULL. — Apparently a rare visitor, but occasionally to be met with on the Niagara River during the winter or spring months. A fine bird in adult plumage was observed in the river below the Falls on May 4, 1924.

Larus leucopterus (Vieillot). ICELAND GULL. — Two mottled immature birds, at first glance referred to the Glaucous Gull, but after careful observation put down as undoubted Iceland Gulls, were seen by the senior author on January 24, 1934, flying back and forth over the rapids immediately above the Horseshoe Falls. In connection with this record it is perhaps interesting to note here that Mitchell,[29] writing on recent records from the Niagara Frontier, N.Y., states that the Iceland Gull has been more numerous than usual in the vicinity during the winter of 1933-34.

Larus marinus Linnaeus. GREAT BLACK-BACKED GULL.—Of somewhat sporadic occurrence in the district. In some winters, notably that of 1934-35, it is comparatively common on the Niagara River, while in others it is rare or absent. Occurs occasionally off the Lincoln County shore line of Lake Ontario, particularly at Port Dalhousie and Port Weller.

Larus argentatus smithsonianus Coues. HERRING GULL. — Plentiful on both lakes and found throughout the two counties wherever there are large bodies of water. Also occasionally met with out in the open fields at some distance from water. This species shares with the Ring-billed Gull the distinction of being one of the two commonest gulls on the Niagara River; always present in considerable numbers throughout the winter months, while odd birds are frequently met with in summer.

Larus delawarensis Ord. RING-BILLED GULL. — This is another very common gull on the Niagara River and during the autumn and early winter months is undoubtedly more plentiful than the preceding and better known species. The status of this gull in other parts of the area under discussion is not so clearly defined, but it occurs commonly along both lake shores.

Larus philadelphia Ord. BONAPARTE'S GULL. — Immense numbers of this beautiful little gull appear on the Niagara River every spring; sometimes in scattered flocks containing a hundred or more individuals and at other times congregating in thousands on some chosen stretch of calm water in either the upper or lower river. This species also visits the river on the return migration in the autumn and frequently over-winters, in comparatively small numbers, at Fort Erie. We have records of this Gull being present on the Niagara River in practically every month of the year. Occurs frequently, but somewhat less plentiful along the lake shore lines of both counties.

Pagophila alba (Gunnerus). IVORY GULL. — A lone Ivory Gull was observed for some considerable time, on a day in December, 1924, as it flew back and forth over the wide expanse of water immediately below the Niagara Falls.

Sterna forsteri Nuttall. FORSTER'S TERN. — The occurrence of a Forster's Tern at Fort Erie

27. *Our Birds in their Haunts*, p. 460, Boston, 1884.
28. *Oologist*, 33 13-14, 1916.
29. *Auk*, 51: 393, 1934.

in Welland County, on September 21, 1935, has been recorded by the Buffalo Ornithological Society.

Sterna hirundo hirundo Linnaeus. COMMON TERN. — A very common visitor to the Niagara River during the spring and autumn migration seasons, sometimes appearing in immense numbers during the latter season. Birds of this species, apparently non-breeding individuals, are common throughout the summer months along the shores of Lake Erie, in Welland County.

Hydroprogne caspia imperator (Coues). CASPIAN TERN. — Apparently of somewhat rare occurrence in the Niagara district. A lone individual was observed on May 4, 1924, as it flew up and down the wide expanse of water immediately below the Falls, and two were seen, in company with Common Terns, Ring-billed, and Herring Gulls, at Morgan's Point, in Welland County, on August 14, 1933. Lincoln County records are equally scarce, but Laing[30] saw three on the lake shore at Beamsville on September 4 and two on September 25, 1918 while, in addition, some recent reports have been received of several being seen near Vineland.

Chlidonias nigra surinamensis (Gmelin). BLACK TERN. — Although the Black Tern cannot be considered a common bird within the district, it occasionally occurs on the Niagara River in considerable numbers. On September 2, 1933, and on August 12, and 16, 1935, scattered flocks of from one to two hundred, in various interesting phases of plumage, were observed near the Peace bridge at Fort Erie; while, although we have no personal knowledge of any such numbers occurring during the spring passage, it is not an uncommon sight to see a few of these handsome little terns on the river during the month of May.

Uria lomvia lomvia (Linnaeus). BRUNNICH'S MURRE.—In an account of a flight of these birds which penetrated inland to Lake Ontario, Lake Erie, and various intermediate points, Fleming[31] mentions reports of their occurrence on the Niagara River, below the Falls, on December 1, 1907.

Alle alle (Linnæus) DOVEKIE. — There is a record by Everett P. Wheeler[32] of a bird of this species being found dead on November 15, 1908, on the Canadian shore of Lake Erie about seven miles from the city of Buffalo; a location which would place the record definitely in Welland County, Ontario. It is stated that the specimen was identified by James Savage of Buffalo.

Columba livia livia Gmelin ROCK DOVE. — Domestic Pigeons which have escaped and become naturalized, and now closely resemble the Rock Dove in plumage and habits, frequent the Niagara River gorge near the Falls. Observations carried out within recent years would tend to indicate that these birds are utilizing ledges on the more inaccessible cliffs for nesting purposes.

Zenaidura macroura carolinensis (Linnaeus). EASTERN MOURNING DOVE. — A common summer bird throughout the district. During the extremely mild winter of 1931-32, many of these doves remained throughout the season, in the vicinity of Vineland, where a flock, containing as many as 35 birds, was frequently seen feeding in an unharvested patch of buckwheat. A few Mourning Doves were again present in the Vineland area during the winter of 1932-33.

Ectopistes migratorius (Linnaeus). PASSENGER PIGEON. — According to Margaret H. Mitchell* in that very thorough piece of work "The Passenger Pigeon in Ontario", the last reported occurrence of Passenger Pigeons in Welland County was in the year 1883. There is apparently no information available in connection with its last appearance in Lincoln County; but it is evident, from the accumulated information in the above mentioned book, that the species formerly occured in immense numbers throughout the Niagara district.

Coccyzus americanus americanus (Linnaeus). YELLOW-BILLED CUCKOO. — Apparently occurs sparingly throughout the two counties. A nest of this cuckoo was found at Vineland on July 31, 1931, which, on examination, was found to contain two young and an unhatched egg. When touched, the young made a buzzing, insect-like noise. One of the parents, remaining in close proximity to the nest, was easily and positively indentified.

Coccyzus erythrophthalmus (Wilson). BLACK-BILLED CUCKOO. — A fairly frequently observed summer bird; apparently breeding throughout the area, and believed to be somewhat more common than the yellow-billed species.

Tyto alba pratincola (Bonaparte). BARN OWL. —An owl, apparently referable to his species, was seen high up in a tree at Vineland Station

30. *Can. Field-Nat.* 34: 21, 1920.
31. *Auk.* 25: 486, 1908.
32. *Bird-Lore.* 2: 174, 1909.

*Contribution No. 7 of the Royal Ontario Museum of Zoology, 1935.

on July 16, 1931. We have definite information to the effect that Barn Owls have been captured recently in the vicinity of St. Catharines.

Otus asio naevius (Gmelin). EASTERN SCREECH OWL. — Common throughout the two counties. Practically all of the birds of this species seen in the vicinity of Vineland have been of the grey phase.

Bubo virginianus virginianus (Gmelin). GREAT HORNED OWL. — This large owl is still to be found in the vicinity of Vineland, as is evidenced by the specimens occasionally killed by hunters. It is, however, rarely seen or heard.

Nyctea nyctea (Linnaeus). SNOWY OWL. — Invasions of the Niagara Peninsula district by this owl are apparently not uncommon, and mounted specimens may be seen in a large proportion of the local collections of stuffed birds. In the late autumn of the year 1926 and again in the early winter of 1934 they appear to have occured in fair numbers throughout the district.

Asio wilsonianus (Lesson). LONG-EARED OWL. — Apparently a rare owl in the Lincoln and Welland County area for we have one record only; a single specimen having been seen by W. L. Putman in the vicinity of Vineland on December 15, 1932.

Cryptoglaux acadica acadica (Gmelin). SAW-WHET OWL. — A single example of this little owl was seen one night toward the end of October, 1926, and watched for a few minutes by the light of a street lamp, after it had settled in a large maple tree, on the main street at the south end of the city of Niagara Falls.

Antrostomus vociferus vociferus (Wilson). EASTERN WHIP-POOR-WILL. — Occasionally seen near Vineland during the spring migration. In the spring of 1932, two Whip-poor-wills spent some time at the Horticultural Experiment Station and made themselves quite notorious by disturbing local residents with their persistent calling just before sunrise and after sunset.

Chordeiles minor (Forster). EASTERN NIGHTHAWK. — A common summer resident throughout both counties. This bird would appear to nest on the roof of one or two of the larger buildings in the city of Niagara Falls.

Chaetura pelagica (Linnaeus). CHIMNEY SWIFT. — Plentiful throughout the district, arriving early in May and usually departing toward the end of August. Now, apparently, nests solely in chimneys; but many years ago nests were found in an old hollow tree at Grimsby park.

Archilochus colubris (Linnæus). RUBY-THROATED HUMMINGBIRD. — A reasonably common summer breeding bird throughout the area; but some decrease in population at nesting time has been noticed of late years in the vicinity of Niagara Falls. Hummingbirds have been observed near Vineland as late as September 27th.

Megaceryle alcyon alcyon (Linnaeus). EASTERN BELTED KINGFISHER. — A common summer resident, frequenting both lake shores and the banks of the Niagara River, and nesting where found.

Colaptes auratus luteus Bangs. NORTHERN FLICKER. — The Flicker is still a very common summer bird; but there is every reason to believe that the Starling is seriously interfering with its nesting operations and its decrease as a breeding bird is already quite noticeable in the Niagara Falls area. This bird has been recorded in the Vineland district during winter; three having been seen on December 1, 1929, near Jordan Harbour, and one near the same locality on March 5, 1932, a date too early for normal spring migration.

Ceophloeus pileatus abieticola Bangs. NORTHERN PILEATED WOODPECKER. — This is apparently a rare bird in the area, but the extensive woodlands near Warner in Lincoln County still harbour a few of these large woodpeckers. Messrs. W. E. Hurlburt and Roger Clarke saw a male bird on June 9. 1935, and on several occasions the unmistakeable work of this species has been seen by a number of different observers visiting the locality.

Melanerpes erythrocephalus (Linnaeus). RED-HEADED WOODPECKER. — This strikingly beautiful woodpecker is somewhat uncommon in either county; but is perhaps more frequently met with in the southern portion of Welland County than in any other part of the territory under discussion. Although one or two pairs are usually observed each year in the vicinity of Vineland, there are occasional summers when it would appear to be entirely absent from that locality.

Sphyrapicus varius varius (Linnaeus). YELLOW-BELLIED SAPSUCKER. — Single examples of the Sapsucker are frequently observed during the spring migration, both at Vineland and at Niagara Falls. In neither locality are they sufficiently numerous, nor do they stay long enough, to do much serious damage, occasionally, ornamental trees, especially Austrian and Scotch pines, suffer severely from their systematic drilling. It has been observed at Niagara Falls on its return migration in the autumn; but its

comparative rarity at that season inclines us to the belief that the majority follow a different route when migrating southward.

Dryobates villosus villosus (Linnaeus) EASTERN HAIRY WOODPECKER. — This bird is fairly frequently observed in the Vineland area during spring, autumn, and winter; but is rarely seen in the vicinity of Niagara Falls at any time.

Dryobates pubescens medianus (Swainson) NORTHERN DOWNY WOODPECKER. — This species is very frequently seen during the winter months and is doubtless quite common in the summer time, although in the latter season it is much less in evidence. Two young birds, just able to fly, were observed at Vineland Station on July 11, 1932.

Tyrannus tyrannus (Linnaeus). EASTERN KINGBIRD. — A very common summer resident, nesting throughout the area, and one of the most conspicuous birds of the rural roadside.

Myiarchus crinitus boreus Bangs. NORTHERN CRESTED FLYCATCHER. — A local, but not uncommon summer resident. Found nesting in the vicinity of Vineland. G. J. Clout of St. Catharines has told us of finding this species building its nest in a receptacle for newspapers by the side of the road, near Niagara-on-the-Lake.

Sayornis phoebe (Latham). EASTERN PHOEBE. — Common throughout both counties. Usually arriving soon after the middle of March, this is a familiar spring and summer bird. Nearly all wooden bridges and old wooden culverts afford a nesting site for these birds; but the gradual replacement of the wooden culverts with those of cement has recently caused many pairs to seek other sites for rearing their young and, in this connection, it is interesting to note their fearlessness in regard to mankind. From Vineland, we have a report of a pair nesting on a beam in the receiving room of a busy canning factory; while, in Welland County, these birds have been found nesting on the verandah of an occupied summer hotel, overlooking Lake Erie.

Empidonax flaviventris (Baird and Baird). YELLOW-BELLIED FLYCATCHER. — Although there are only three definite records of this bird from the Vineland area during the past ten years, nevertheless it is believed to be a fairly regular migrant in that locality. Its close resemblance to the Least Flycatcher may easily have caused many examples to be overlooked. Laing[33] saw two at Beamsville on September 2, 1918.

33. *Can. Field-Nat.* 34: 23, 1920.

Empidonax minimus (Baird and Baird). LEAST FLYCATCHER. — The Least Flycatcher is a regular spring migrant in the vicinity of Vineland and has occasionally been observed near Niagara Falls. It may usually be looked for about May 10, at which time the characteristic call note, *"chebec,"* has been found a most useful medium for drawing attention to the presence of this species.

Myiochanes virens (Linnaeus). EASTERN WOOD PEWEE. — A regular, but not abundant, summer resident throughout the area. One or more nests have been found in orchards on the Experimental Farm at Vineland for many years in succession.

Otocoris alpestris praticola Henshaw. PRAIRIE HORNED LARK. — A common and well-distributed species throughout the district. It has been observed in the Vineland area in nearly every month of the year.

Iridoprocne bicolor (Vieillot). TREE SWALLOW. — Occurs only rarely in the vicinity of Niagara Falls. Formerly a regular spring migrant at Vineland, usually appearing during the latter part of April; but we have no personal records from that locality for the last three years.

Riparia riparia riparia (Linnaeus) BANK SWALLOW. — A very common summer resident, nesting wherever suitable cliffs occur, along both lake shores, and at several places near Niagara Falls. This swallow usually arrives about the first of May and departs toward the end of August. A few weeks before departure they frequently congregate in very large flocks along th Niagara River, the Welland River, and on both lake fronts. On July 12, 1924, a pure white Bank Swallow was observed near Vineland, flying around in company with a large flock of normal birds. This albino swallow was observed daily from the 12th until the 18th, after which date the entire flock departed.

Stelgidopteryx ruficollis serripennis (Audubon) ROUGH-WINGED SWALLOW. — Occurs at Niagara Falls during both spring and autumn migration seasons. Also nests in limited numbers in the Niagara River gorge, and in the rock-cut of the Hydro Electric Power Canal. This species does not appear to be very plentiful at any time, but on August 17 and 18, 1933, careful count was made of several mixed flocks, composed of Bank and Rough-winged Swallows, and it was found that the Rough-wings made up from 5% to 20% of the total number of birds in the various flocks examined.

Hirundo erythrogaster Boddaert. BARN SWALLOW. — A fairly common summer bird throughout both counties. As a breeding bird, this spe-

cies is probably more numerous around the mixed farming lands of Welland and the higher parts of Lincoln than it is in the lower-lying, fruit-growing areas of the latter county. The comparative scarcity of breeding birds in the fruit-growing districts may be accounted for by the fact that so many of the fruit farmer's barns are kept closed and so do not offer a convenient nesting site.

Petrochelidon albifrons albifrons (Rafinesque). NORTHERN CLIFF SWALLOW. — We have no recent or personal records of this swallow to report; but Laing[34] in his account of bird migration at Beamsville, writes of seeing a few small parties on August 5, 1918, one on September 8 and a doubtful one on September 19th.

Progne subis subis (Linnaeus). PURPLE MARTIN. — A reasonably common but very local summer bird in Welland County. Breeds in houses put up for its use in the gardens of summer homes along the Lake Erie shore line. Rare elsewhere in the county, although there are at least two or three occupied Martin houses in the city of Niagara Falls. In Lincoln County it is somewhat less common, but is locally established in small colonies the largest of which is situated on the main street in St. Catharines, where moderate numbers of these cheerful birds nest in the upper portions of old stores. Many houses have been erected for the use of these birds throughout the district but, unfortunately, the omnipresent House Sparrow and Starling usually prevent the desired tenants from taking possession.

Cyanocitta cristata cristata (Linnaeus). NORTHERN BLUE JAY. — The Blue Jay is a fairly common resident in the more secluded patches of wooded land throughout the district. While not usually classed as a migrant in this part of Ontario, it has twice been observed in flocks on the Experimental Farm at Vineland. In May, 1924, about 10 were seen passing through the farm, while in 1932 a flock of over 50 settled for a short time in two apple trees before joining a larger flock of what were presumed to be Blue Jays passing overhead.

Corvus brachyrhynchos brachyrhynchos Brehm. EASTERN CROW. — Formerly abundant, both winter and summer, in the vicinity of Niagara Falls; now considerably reduced in numbers and can only be considered as being fairly common. In former times, the Niagara River gorge was a famous winter Crow Roost and fifty years ago the Rev. Hibbert Langille[35] wrote of countless numbers roosting on the steep slopes of the river between the Falls and Queenston. In more recent times there was a substantial remnant of this large winter roost in the vicinity of the Whirlpool and Niagara Glen; but about ten years ago this was apparantly abandoned, for the large flocks which used to fly regularly, at sunset, in a northerly direction, over the city of Niagara Falls, gradually became irregular in their movements and were later found to be congregating in great numbers in a large area of rough wooded land, adjoining the Montrose railway yards, a mile or so south of the city. Wood-cutting operations and the efforts of local sportsmen have now, apparently, caused the birds to abandon this second roost, for of late years the large flocks have disappeared and the crow is now observed in the district only singly, in pairs, or in small scattered parties. At Vineland, we have no record of any large winter roosts; but Crows may be seen in moderate numbers during the summer, and a few odd birds appear to stay in the vicinity throughout the winter.

Penthestes atricapillus atricapillus (Linnaeus). BLACK-CAPPED CHICKADEE. — The "Chickadee" is quite comomnly observed every winter; but it is a bird which appears to be subject to considerable fluctuations in abundance from year to year.

Penthestes hudsonicus hudsonicus (Forster). HUDSONIAN CHICKADEE. — A single individual of this somewhat rare visitor was seen near Niagara Falls in the winter of 1919 in company with a small party of the common Chickadee. It is possible that this record should be referred to the Acadian Chickadee. *P. h. littoralis;* but, of course, such a point could be determined only by collection.

Sitta carolinensis carolinensis Latham. WHITE-BREASTED NUTHATCH. — A reasonably common bird throughout the two counties; to be seen regularly every winter, both at Niagara Falls and at Vineland. Also observed in summer, but not so regularly.

Sitta canadensis Linnaeus. RED-BREASTED NUTHATCH. — A regular spring migrant at Vineland, where it is mostly seen singly. Occosionally observed in small parties, among the ornamental trees in Queen Victoria park, at Niagara Falls.

Certhia familiaris americana Bonaparte. BROWN CREEPER. — This somewhat shy and unobtrusive

34. *Can. Field-Nat.* 34: 24, 1920.

35. *Our Birds in their Haunts*, p. 63, Boston, 1884.

little bird cannot be considered as a very common species in the Niagara district but it has been observed fairly frequently, at Niagara Falls and at Vineland, during the spring migration. It has been seen occasionally during the winter months.

Troglodytes aëdon aëdon Vieillot. EASTERN HOUSE WREN. — An abundant, but somewhat locally distributed, summer breeding bird. In Lincoln County it is exceedingly common in the vicinity of Vineland, where it patronizes the many nesting boxes put up for its benefit; while, in Welland County, it is common near Port Colborne and along the lake shore, but comparatively rare in the city of Niagara Falls, where, however, a few pairs can always be found in suitable garden areas.

Nannus hiemalis hiemalis (Vieillot). EASTERN WINTER WREN. — In the Vineland area, the Winter Wren is seen regularly as a spring migrant and quite frequently as a winter resident; but in the vicinity of Niagara Falls it does not appear to be so regular, although occasional individuals are observed in late autumn or early spring. During the latter season the surprisingly loud song of this little bird is not infrequently to be heard in the Niagara Glen.

Thryothorus ludovicianus ludovicianus (Latham). CAROLINA WREN. — A single example of the Carolina Wren haunted the grounds of the Experimental Farm at Vineland Station throughout the winter of 1932-33. It was first observed on December 12, 1932, and from that date on was seen or heard almost daily by various members of the staff. During the months of January and Febrary, 1933, it made itself locally quite notorious by its loud clear song given chiefly in the early morning. W. E. Saunders[36] in an article entitled "Super-singers" mentions a Carolina Wren which was heard singing by a friend of his at Grimsby in Lincoln County, on July 27, 1927.

Telmatodytes palustris dissaëptus (Bangs). PRAIRIE MARSH WREN. — Although we have only two or three personal records of this bird, it is believed to be not uncommon in the marshy areas in the vicinity of Jordan Harbour and Vineland. G. J. Clout of St. Catharines has told us of finding two cock's nests of this species in the vicinity of Niagara-on-the-Lake on June 16, 1935. There is a winter record by Messrs. Dickson, Hurlburt, and Palmer[37] of a wren, apparently referable to this species, observed near Jordan, on December 24, 1926.

Cistothorus stellaris (Naumann). SHORT-BILLED MARSH WREN. — No personal records, but G. J. Clout of St. Catharines has told us of seeing a wren of this species at Rosedene near that city, on April 24, 1932.

Mimus polyglottos polyglottos (Linnæus). EASTERN MOCKINGBIRD. — A Mockingbird spent the winter of 1931-32 in the grounds of the Horticultural Experiment Farm at Vineland Station. It was first definitely indentified on December 5, 1931, and last seen late in March or early in April, 1932. This bird appeared to subsist almost entirely on the very abundant berries of the Boston Ivy which covers both the south and east walls of the Administration Building. It was tame and could be approached to within a distance of about ten feet and was closely observed, on numerous occasions, by local bird students, as well as, on one occasion, by a party from the Brodie Club of Toronto. We have no other personal record of the Mockingbird within the territory under discussion but J. H. Fleming[38] records having seen one at McNab, in Lincoln County, on May 12, 1928.

Dumetella carolinensis (Linnæus). CATBIRD.— A common summer bird thoughout the district, nesting wherever suitable cover is to be found.

Taxostoma rufum (Linnæus) BROWN THRASHER. — Not a particularly common bird but to be found locally here and there throughout the two counties. Clumps of thorn bushes appear to be the favourite nesting site, and, and nests in such situations have been recently found in the vicinity of Vineland.

Turdus migratorius migratorius Linnæus. EASTERN ROBIN. — A very abundant summer resident, arriving about March 20th or earlier and usually departing toward the end of October. Occasionally small flocks remain in the vicinity of Niagara Falls until nearly the end of November and in some years odd birds have been observed in December and January. Mr. N H. Culp, of Vineland Station, in his collection of mounted birds has a melanistic Robin which was taken locally about the year 1904. Partially albino birds, with a varying amount of white in the plumage, have been observed occasionally, both at Niagara Falls and at Vineland.

Hylocichla mustelina (Gmelin). WOOD THRUSH. — A regular spring visitor at Vineland, usually arriving about May 10th. Former-

36. *Oologist*, 45: 112-6, 1928.
37. *Can. Field-Nat.* 41: 15, 1927.
38. *Auk*, 47: 71, 1930.

ly quite commonly observed at Niagara Falls but not very frequently seen during the recent years.

Hylocichla guttata faxoni Bangs and Penard. EASTERN HERMIT THRUSH. — An early and regular spring migrant at Vineland. Occasionally observed in the vicinity of Niagara Falls during both spring and autumn migration seasons.

Hylocichla ustulata swainsoni (Tschudi). OLIVE-BACKED THRUSH. — Apparently an uncommon visitor to the Niagara district, for we appear to have only five observations of this bird to report; four at Vineland during the latter part of May, 1931, and at Niagara Falls in May, 1924.

Hylocichla minima aliciae (Baird). GRAY-CHEEKED THRUSH. — We have no personal records of this thrush; but, under a question mark Laing[39] reports the occurrence of one at Beamsville on October 7, 1918.

Hylocichla fuscescens fuscescens (Stephens). VEERY. — Quite frequently observed during the spring migration, both at Niagara Falls and at Vineland. Believed to nest on the sloping wooded banks at the back of Queen Victoria Park near Niagara Falls, also in the Whirlpool and Niagara Glens. A nest, apparently belonging to this bird, was found in a large area of swampy wooded land, on the Lincoln-Haldimand County border, south of Smithville, on May 31, 1931.

Sialia sialis sialis (Linnæus). EASTERN BLUEBIRD. — A reasonably common, but somewhat local, summer bird, arriving about the same time as the Robin and usually leaving the Niagara Falls area toward the middle of October. This beautiful and familiar bird appears to be holding its own and even increasing of late years, in Welland County; but in the Vineland area of Lincoln County, where sparrows appear to have interefered seriously with its nesting, it is now seen mostly as a migrant; although, in the more secluded parts of that County, it is still fairly common as a breeding bird.

Regulus satrapa satrapa Lichtenstein. EASTERN GOLDEN-CROWNED KINGLET. — A common spring and autumn migrant; often abundant in the former season and quite frequently observed during the mid-winter months.

Corthylio calendula calendula (Linnæus). EASTERN RUBY-CROWNED KINGLET. — Frequently seen at Vineland during the spring migration and occasionally observed in Queen Victoria park, at Niagara Falls.

Anthus spinoletta rubescens (Tunstall). AMERICAN PIPIT. — We do not appear to have any recent records of the occurrence of this species but in former years it was occasionally observed in the Niagara Falls area while on migration. Laing[40] reports several on passage at Beamsville between September 13 and October 31, 1918.

Bombycilla cedrorum Vieillot. CEDAR WAXWING. — A reasonably common summer bird in the vicinities of Vineland and Niagara Falls, breeding in both localities and in other suitable areas throughout the two counties. Occasionally observed during the winter months.

Lanius borealis borealis Vieillot. NORTHERN SHRIKE. — This northern bird has been occasionally observed in the vicinity of Vineland during the early part of the winter, most of the occurrences being in the month of November.

Lanius ludovicianus migrans Palmer. MIGRANT SHRIKE. — A somewhat uncommon summer resident, occasionally observed in Welland County. Nests have been found in the vicinity of Vineland in Lincoln County, clumps of thorn trees, or bushes, being selected for a site.

Sturnus vulgaris vulgaris Linnæus. STARLING. — An exceedingly common resident. Abundant during the spring and autumn months and formerly almost as abundant in winter; but, during the last few winter season the very large flocks seem to have disappeared and the starling now occurs during the cold months in comparatively small parties, composed of from twenty to thirty or more individuals, which are found scattered here and there throughout the district, with somewhat larger concentrations in the cities and towns. According to Harrison F. Lewis[41], in his excellent account of the European Starling in Ontario, the earliest known record of the starling in Lincoln County, and incidentally the second for the Province, was made at St. Catharines by Mrs. R. W. Leonard, who saw a small flock of these birds in the winter of 1919-20. The same authority is responsible for a statement to the effect that it was probably present at Fort Erie, Welland County, about 1920, and in support of this statement mentions a letter received on December 28, 1925, from A. A. Edwards, of Black Creek, stating that Starlings were first seen at Fort Erie about five years ago. The senior author, who has been familiar with this bird since boyhood, has a distinct recollection

39. *Can. Field-Nat.* 34: 26, 1920.

40. *Can. Field-Nat.* 34: 25, 1920.

41. *Univ. Toronto Biol. Series.* 30: 8, 1927.

of seeing a small party of about 4 or 5 Starlings alight in a tulip tree in a garden close to the Michigan Central Railway tracks near the centre of the city of Niagara Falls, Ontario, in the autumn of 1914, shortly before returning to England for war service. Unfortunately the significance of the observation was not realized at the time and no notes of the occurrence were made. The first records in our diaries of the Starling at the eastern end of the Niagara peninsula do not commence until about 10 years later, six being observed at Vineland on February 13, 1924, while a flock of several dozen was seen in the autumn of that same year at Montrose near Niagara Falls. In the winter of 1924-25, the Starling was fairly common in the city of Niagara Falls and, even at that time, had begun to attract attention. Very few birds have received so much publicity as the Starling and it is not our intention, at this time, to enter into a long discourse on the merits or demerits of this ubiquitous species. It will, however, perhaps not be out of place to mention here that this bird is in very bad repute, if not heartily detested, in the soft-fruit-growing communities of Lincoln County, for here in such areas, serious damage is only too frequently occasioned to the ripening crops of cherries and grapes by large flocks of Starlings. In other sections of the two counties under discussion, where soft fruits are not cultivated, the Starling is looked upon with tolerance; but even in such places, where no apparent damage is done, farmers and city dwellers are lifting up their voices against this alien bird. Weighed in the balance, the Starling's capacity for good or evil would appear to depend very largely upon the type of country in which it is found. In ordinary mixed farming and market garden areas, its destruction of root-injuring grubs and other noxious insects weighs heavily in its favour; but, in the specialized commercial orchard sections, the damage caused by the large flocks in late summer may on occasion considerably overbalance any good it may have done earlier in the season.

Vireo flavifrons Vieillot. YELLOW-THROATED VIREO. — This species appears on an early list of Niagara Falls birds, as entered in our diary up to 1925; but unfortunately, without special note. We do not appear to have any very recent record of the occurrence of this Vireo within the area. Laing[42] reports an individual of this species, under a question mark, as occurring at Beamsville on September 8, 1918.

42. *Can. Field-Nat.* 34: 25, 1920.

Vireo solitarius solitarius (Wilson). BLUE-HEADED VIREO. — During a trip on October 6, 1935, along the Canadian shore of Lake Erie, presumably in Welland County, members of the Buffalo Ornithological Society observed two Blue-headed Vireos. This bird is to be expected within the area, and it is somewhat surprising that it has not been found by our own observers.

Vireo olivaceus (Linnæus). RED-EYED VIREO.— A common summer resident, nesting in suitable locations throughout both counties.

Vireo gilvus gilvus (Vieillot). EASTERN WARBLING VIREO. — The Warbling Vireo is not uncommon in the Vineland area, where it is usually seen as a spring migrant which arrives about the same time as the Red-eye. It is believed to be quite common at Niagara Falls and to nest in shade trees in the residential sections of the city; but this supposition has not yet been definitely substantiated.

Mniotilta varia (Linnæus). BLACK AND WHITE WARBLER. — A very common spring migrant, usually appearing in the Niagara Falls area during the second week in May. In the Vineland district it has been noticed to show a great partiality for old apple orchards where the rough bark of the trees affords a good hunting ground for insects and in such places it is apt to linger for several days on its northward flight.

Protonotaria citrea (Boddært). PROTHONOTARY WARBLER. — This large and distinctive Warbler has been observed at Vineland on four seperate occasions; namely on June 2, July 26 and August 10, 1929, and on May 25, 1931.

Vermivora chrysoptera (Linnæus). GOLDEN WINGED WARBLER. — A female of this species was seen in company with a mixed flock of migrants in the woodlands near Warner, in Lincoln County, on August 20, 1933. Messrs. W. E. Hurlburt, Douglas Ross, and George North observed two singing males in this same general location on June 2, 1935, while another singing male was seen in the same woods on June 9, 1935.

Vermivora peregrina (Wilson). TENNESSEE WARBLER. — Observed at Vineland on several occasions during the spring migration periods. We do not appear to have any definite records from Welland County, but it is believed to occur occasionally at Niagara Falls.

Vermivora celata celata (Say). ORANGE-CROWNED WARBLER. — Recorded from the Canadian shore of Lake Erie, presumably in Welland County, on October 6, 1935, by the Buffalo Ornithological Society.

Vermivora ruficapilla ruficapilla (Wilson). NASHVILLE WARBLER. — No personal records, but G. J. Clout of St. Catharines has told us of his observation of this warbler in a pine grove near DeCew Falls on May 19, 1935.

Compsothlypis americana pusilla (Wilson). NORTHERN PARULA WARBLER. — Frequently seen in the Vineland district of Lincoln County during the spring migration.

Dendroica aestiva aestiva (Gmelin). EASTERN YELLOW WARBLER. — A common summer resident, often arriving before the middle of May. Great numbers pass on northward with the other Warblers but a considerable number remain to nest within this district.

Dendroica magnolia (Wilson). MAGNOLIA WARBLER. — The Magnolia Warbler is a fairly common and regular spring migrant in the Vineland area its numbers varying little from year to year. Observed occasionally at Niagara Falls, generally during the last week of May.

Dendroica tigrina (Gmelin). CAPE MAY WARBLER. — Although perhaps not so numerous as some of the other species and more inclined to fluctuate in numbers from year to year, the Cape May Warbler is a regular spring visitor in the Vineland district. It has been met with in the vicinity of Niagara Falls but we are inclined to think that it is one of the more uncommon of the Warblers which pass through this particular locality.

Dendroica caerulescens caerulescens (Gmelin). BLACK-THROATED BLUE WARBLER. — A regular and abundant spring migrant in the vicinity of Vineland but only occasionally observed in the Niagara Falls area.

Dendroica coronata (Linnæus). MYRTLE WARBLER. — Probably the most numerous of the Warblers passing through this area; abundant in passage both spring and autumn. Unusually large numbers of this species were noted, both at Niagara Falls and at Vineland, during a period of a few days about the middle of October, 1932.

Dendroica virens virens (Gmelin). BLACK-THROATED GREEN WARBLER. — A regular spring migrant at Vineland, but never seen in numbers. Occasionally observed near Niagara Falls, usually toward the end of May.

Dendroica cerulea (Wilson). CERULEAN WARBLER. — Apparently rare and very local. Messrs. G. H. Dickson and Roger Clarke saw a warbler of this species at Warner, in Lincoln County, on June 25, 1933, and W. E. Hurlburt heard the song of the Cerulean at the same place, about a week earlier. Several were heard singing and one closely observed in the woodlands near Warner on June 2, 1935.

Dendroica fusca (Muller). BLACKBURIAN WARBLER. — Regular and sometimes abundant as a spring migrant at Vineland. Observed in the immediate vicinity of Niagara Falls but not regularly or in numbers.

Dendroica pensylvanica (Linnæus). CHESTNUT SIDED WARBLER. — A common spring migrant at Vineland and occasionally seen on the return migrations in the autumn. This Warbler has been observed at Niagara Falls, usually during the last week in May, but not commonly.

Dendroica castanea (Wilson). BAY-BREASTED WARBLER. — The Bay-breasted Warbler is a regular spring migrant in the Vineland area, where it is sometimes seen in fair numbers. Not uncommon on migration in the immediate vicinity of Niagara Falls generally appearing during the last few days of May.

Dendroica striata (Forster). BLACK-POLL WARBLER. — Occurs occasionally, both at Niagara Falls and at Vineland, while on migration during the latter part of May, but it does not appear to be one of the commoner Warblers passing through this area.

Dendroica discolor discolor (Vieillot). NORTHERN PRAIRIE WARBLER. — We have no personal observations to record, but G. J. Clout of St. Catharines has informed us that he saw a pair of Prairie Warblers on the breakwater at Fort Weller in Lincoln County on September 9, 1934.

Dendroica palmarum palmarum (Gmelin). WESTERN PALM WARBLER. — This Warbler does not appear to be at all common, for we have only seven spring records all of them from Vineland area, where the birds were observed feeding on the ground in a plum orchard about the time that the trees were in full bloom.

Seiurus aurocapillus (Linnæus). OVEN-BIRD.— Commonly seen every spring and believed to nest in the Vineland area.

Seiurus noveboracensis noveboracensis (Gmelin). NORTHERN WATER-THRUSH. — A rather uncommon spring migrant, but occasionally observed at Niagara Falls and at Vineland.

Seiurus motacilla (Vieillot). LOUISIANA WATER-THRUSH. — There would appear to be no doubt that the Louisiana as well as the Northern Water-Thrush occurs within the area, but our earlier notes do not always clearly differentiate between the two species. A summer record from Vineland, on August 9, 1927 should probably be referred to *S. motacilla*;

while Mr. G. J. Clout has described a Water-Thrush which he saw near St. Catharines, which could not have been other than this species.

Oporornis agilis (Wilson). CONNECTICUT WARBLER. — This rare warbler has been recorded from the Canadian shore of Lake Erie, presumably Welland County, by the Buffalo Ornithological Society, in their mimeographed journal "The Prothonotary" for October, 1935. In the same number of this journal, three examples of the Connecticut Warbler are reported from Grand Island, N.Y., which is of course, only just outside our territory.

Geothlypis trichas brachidactyla (Swainson). NORTHERN YELLOW-THROAT. — Frequently seen during the spring migration season and some remain to nest within the area. Numbers were seen and heard singing in the woods near Warner, in Lincoln County, on June 25, 1933, and a nest with 5 eggs was found in that locality on June 9, by Roger Clarke.

Icteria virens virens (Linnæus). YELLOW-BREASTED CHAT. — We appear to have only one personal record of this bird within the area, that of an example seen near Vineland on May 24, 1924; but, in addition to this record, one other is reported, by Mr. Ernest Rittenhouse, to have been seen in the grounds of the Horticultural Experiment Station, a year or two earlier.

Wilsonia pusilla pusilla (Wilson). WILSON'S WARBLER. — While not common, Wilson's Warbler is a regular spring migrant in the Vineland area, where it usually arrives during the latter part of May. It would appear that this species is not quite so regular in the time of its arrival as some of the other warblers, for in 1932 it put in an appearance as early as May 11th. In connection with the 1932 spring migration of this species through Vineland, it may be of interest to mention here that in one party was observed a very unusually marked bird, with a clearly defined yellow patch in the centre of the black cap, a distinction which made it quite conspicuous among its more normal companions.

(To be concluded)

NOTES AND OBSERVATIONS

THE SHORT-BILLED MARSH WREN BREEDING AT TORONTO. — During the past ten years, the Short-billed Marsh Wren (*Cistothorus stellaria*) has been found to be a more common summer resident in the Toronto region than was formerly supposed. In localities such as Erindale, Leaside, Simcoe Point marsh and the Holland river flats suitable habitats are provided for this diminutive marsh dweller and the birds have been found occupying them in some numbers during the past few years.

Early records of the occurrence of this species in the Toronto region are rather meagre. J. H. Fleming mentioned only two records[1] of the Short-billed Marsh Wren in his list of Toronto birds published in *The Natural History of the Toronto Region*, 1913. There is, however, a set of eggs of this species in the collection of W. E. Saunders, taken in a Toronto marsh about 1883, by Charles Shuttleworth.[2]

Further evidence of its breeding was not forthcoming until 1926, when J. L. Baillie, while making ornithological investigations on the grassy flats bordering the Holland river, King township, collected a female which had eggs almost ready for extrusion. Although the surrounding area was searched, no nest was found. This has been recorded by L. L. Snyder.[3]

In view of the paucity of information regarding its breeding at Toronto, I wish to contribute the following record of a nest and young found in June, 1935, which is apparently the first nest to be collected locally.

A favourite spot to find Short-billed Marsh Wrens is the Simcoe Point marsh near the mouth of Duffin's creek which flows through the village of Pickering, in Ontario county, 18 miles east of the city limits. Here the writer has observed them during the past three summers (1933-34-35). Early in June, 1935, five males were observed singing at this marsh. The general location was noted in the hope that on a subsequent visit a more detailed study of the species might be made. Returning on June 30th, the males were singing as before, but my attention was focused on one particular bird which fluttered nervously between several singing perches consisting of last year's cat-tail stalks.

1 C. W. Nash, *Auk*, Vol. 13, 1896, p. 347.

2 Thomas McIlwraith, *Birds of Ontario*, 1886, p. 289, and W. E. Saunders, *Biological Review of Ontario*, Vol. 1, No. 3, July 1894, pp. 51-2.

3 L. L. Snyder, *Trans. Royal Canadian Institute*, Vol. xvii, p. 200, 1930.

Secreting myself nearby, I presently saw another wren, presumably the female, skimming low over the sedge, carrying food. She dropped into the vegetation near one of the singing perches. After a wait of half an hour during which time the female made three trips to the same general area, I decided to investigate. The female flushed when I was several feet away and it was some few minutes before the carefully concealed nest was located in a dense clump of sedge. It was entirely hidden from above. Examination showed it contained seven partially fledged and helpless young. After replacing the young in the nest, the spot was marked so that on our next visit pictures of them being fed might be obtained.

On July 5th, F. H. Emery, C. E. Molony and the writer returned to the marsh, equipped with photographic paraphernalia. Imagine our surprise, when within a yard of the nest, the young bolted with the exception of one which we caught and managed to photograph. Three others were located in the grass by following up their tiny squeaks.

The nest was composed of sedges and fine grasses and a few dry cat-tail leaves interwoven into a ball-shaped mass and situated in a dense clump of small-leaved sedges, 12 inches above the ground. It was lined with cat-tail down and feathers of the Ring-necked Pheasant (*Phasianus colchicus torquatus*) which is a common bird there. The nest measured 4 inches in height and 3½ inches in width. The entrance was 1¼ inches in diameter and faced in an easterly direection. The ground beneath the nest was quite dry, the water of the marsh proper being 25 feet away. A thorough search of the surrounding area revealed no false nests.

One of the young was collected as a record and it, along with the nest, is now in the Royal Ontario Museum of Zoology at Toronto.

The writer wiches to acknowledge his indebtedness to Mr. J. L. Baillie of the Royal Ontario Museum of Zoology for his constructive criticism and for information on early Toronto records.
— C. E. DEVITT, *Toronto, Ont.*

RED WING CONCENTRATION. — Near a roadway over which I have often travelled, not far from my home lies a small marsh. As a feature on the landscape it is very insignificant, one could walk completely around its outer edge in less in than three minutes. In summer it stands out as a patch of waving cat-tails in the midst of cultivated fields; and in winter, as a spot of brown crumpled reeds surrounded by blank whiteness. Alone, unlike any other habitat for miles around, such a spot becomes an object of interest — a good place to drop off and examine while motoring by, and an objective on a snowshoe tramp over the fields. Here, when the surrounding fields were flourishing with field-loving birds I have found the black duck, the sora rail, the American bittern and many red-winged blackbirds, and in winter, when all about was barren of life, the tracks in the snow of European hare, the cottontail, the field vole and the deer mouse, the unmistakable trail of the pheasant and the less certain marks of the song, swamp and tree sparrows seeking shelter in the rank though friendly herbage. So that my pond, or slough as it would be called in the west, is a little world of its own, differing as it does so markedly from the surrounding country in both animal and vegetable life.

On June 3rd, 1935, I visited the spot to examine its life more than casually. Without going into all that was found the most noticeable thing was the number of red-winged blackbirds that had made this tiny oasis their home. I have mentioned the size of the marsh — some 50 yards in diameter, deduct from this about 30 yards of open water in the center, there is left a very limited area growing in cat-tails. Yet in this area I found 35 nests of the red-wing. Some of these were partly built, some finished, many contained eggs or young or both. A careful check was as follows:

Empty nests, unfinished or finished	8
Nests with eggs	16
Nests with young and eggs	5
Nests with young	6
	35
Total number of eggs	66
Total number of young	28
	94

Considering the small area examined this shows a surprising concentration of population. Although this species can generally be considered a common bird, never in all the many marshes I have waded were their nests so numerous and so close to each other as in this. Nests were often within a few inches of their neighbours. Yet strange to say I only counted fifteen red-wings of both sexes in the whole marsh. And, as it was evening, I have reason to believe all inhabitants of this marsh should be here. It is of course well known that the red-wing is polygamous. But one cannot help but wonder how many seasons this tiny marsh could ac-

commodate the red-wings returning in spring to their home territory even making all allowances for migration casualties. Grant that only roughly 50% of the birds return the following spring, we ought to find some some sixty birds trying to nest in this already crowded area. However that remains to be seen. At present, conditions as they are present a very good example of how a species, especially if it be at all gregarious, will concentrate in a suitable habitat even though decided limited. — STUART L. THOMPSON.

BIRD NOTES FROM GRAND MANAN, NEW BRUNSWICK. — Through the courtesy of Mr. Allan Moses of North Head, Grand Manan, I have the following interesting records to report.

Quiscalus quiscula quiscula. PURPLE GRACKLE.— Apparently adult male, taken on Kent's Island, (an islet south of Grand Manan), November 20, 1931, by R. Griffin, now mounted in the Moses collection. I had the pleasure of examining this specimen through loan and can fully corroborate the identification. There is a strong suffusion of purple instead of brassy bronze on back and wings, and the distinctive "peacock" semicircles are very conspicuous along the edges of the scapulars and on sides of breast. This subspecies occurs in many of the reports of early Canadian ornithologists but all that have previously been subject to verification have proved to be misidentifications of *Q. q. æneus.* This seems to be the first definite record of the subspecies in Canada.

Spatula clypeata. SHOVELLER. — Changing from juvenile to adult male plumage, Nantucket Island (near Grand Manan), January 5, 1935, now deposited in the National Museum of Canada. This is the only representative of the species that Mr. Moses has seen in the Grand Manan area. Harold Herrick in his *Partial List of the Birds of Grand Manan,* 1873, lists it as "rare" and George Boardman, *Birds of the St. Croix,* 1900, cites it as "very rare; accidental". Gilpin, 1882, reports a specimen from Halifax, and Downs, 1888, dismisses it as "rather rare migrant" in Nova Scotia. Chamberlain, 1887, makes no mention of the species in the eastern provinces. Individual specimens have been taken at Romaine, Canadian Labrador and the Magdalen Islands. This about completes the references to the species in the Maritime Provinces. — P. A. TAVERNER, *National Museum of Canada, Ottawa.*

Deroceras hyperboreum Westerlund ON BAFFIN ISLAND. — One lot of more than ten specimens of this species (or variety of *D. agreste* according to some authorities), was collected at Lake Harbour, Baffin Island, on the 17th of September, 1935, by Dr. W. J. Brown of the Entomological Branch of the Department of Agriculture. The specimens were presented to the National Museum.

The presence of *D. hyperboreum* in this locality is not unexpected since it has been found as far to the north at other points but to the knowledge of the writer it has never been specifically recorded for Baffin Island until now.

Collectors having an opportunity to work in the north are urged to get as many land and fresh-water mollusca as possible since so little is known of their distribution in that area. Specimens will be gratefully received by the National Museum and in all cases will form valuable additions to its collections. — A. LA ROCQUE.

REVIEW

THE MARINE FISHES OF NOVA SCOTIA, *by V. D. Vladykov and R. A. McKenzie. Proc. N. S. Inst. Sci.* 19:17-113, 1935. *Reprint for sale at* $1.50.

This paper consists of keys for the indentification of 151 species of fish found in the waters of Nova Scotia, with a brief discussion of the status of each species in local waters, its commercial importance if any, abundance and general range.

This publication should be a great convenience to anyone interested in the fishes of the Atlantic coast of Canada. By bringing together the scattered information on the occurrence of fishes in the waters off the coast of Nova Scotia, it makes an important contribution to Canadian ichthyology. — J. R. DYMOND.

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The official publications of THE OTTAWA FIELD-NATURALISTS' CLUB have been issued since 1879. The first were *The Transactions of the Ottawa Field-Naturalists' Club*, 1879-1886, two volumes; the next, *The Ottawa Naturalist*, 1886-1919, thirty-two volumes; and these have been continued by *The Canadian Field-Naturalist* to date. *The Canadian Field-Naturalist* is issued monthly, except for the months of June, July and August. Its scope is the publication of the results of original research in all departments of Natural History.

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The Canadian Field-Naturalist

VOL. L OTTAWA, CANADA, DECEMBER, 1936 No. 9

THE BIRDS OF OTTAWA

Addenda to February 28, 1935

By HOYES LLOYD

THESE ADDENDA to the Ottawa list have been prepared to keep the published record of Ottawa birds up to date, so far as possible. A general list was published in 1923[1], and there have been two addenda[2] prior to these. The 1930 total was 245 species; Mr. C. E. Johnson added the Barn Owl, 1933; Mr. P. A. Taverner, the Madeira Petrel, in 1934; and three species are added in this list, the Sabine's Gull, the Blue Goose and the Ring-billed Gull, making the total now appear to be 250.

1. *Oceanodroma castro* (Harcourt). MADEIRA PETREL. — A new species for Ottawa and for Canada was recorded by P. A. Taverner.[3] I am advised that Master Bunny Sunderland and Mr. James Austin, Manager of Brighton Beach, found the bird alive on August 28, 1933, but that it died soon afterwards.

2. *Chen caerulescens* (Linnæus). BLUE GOOSE. — Mr. Eugene Bedard shot two juveniles on October 24, 1930, near Rockcliffe Aerodrome, and on October 25, 1930, saw seven at the Petrie Islands. Seven birds, probably the same, were seen at Lochaber Bay during the same week.

On November 7, 1934, a juvenile Blue Goose joined the domestic geese at the water-fowl enclosure of the Central Experimental Farm at Dow's Lake, Ottawa. It was given time to accommodate itself to its new surroundings and then, on November 9th, it was driven under cover without any difficulty and wing-clipped. Mr. E. F. G. White and I saw it on November 15th and were surprised at its remarkable tameness.

These are the first definite records of occurrence of this species at Ottawa.

3. *Mareca penelope* (Linnæus). EUROPEAN WIDGEON. — Since only one[4] previous record for this species is available for the Ottawa district two recent occurrences are of interest. On October 27, 1934, Wm. Page shot a female at Fish Bay, Lochaber, Quebec. It was identified by E. F. G. White and P. A. Taverner. On November 3, 1934, H. Bedard of Rockcliffe Annex, shot one at Dubee Island, Quebec, near Wendover, Ontario. This specimen was indentified by E. F. G. White.

4. *Rallus limicola limicola* (Vieillot). VIRGINIA RAIL. — Another nesting date is furnished by C. E. Johnson who found a nest with three young near Billings' Bridge on the Rideau River, August 12, 1934. The nest, which was collected for the National Museum, was placed among Horsetail reeds and constructed of the same material.

5. *Philohela minor* (Gmelin). AMERICAN WOODCOCK. — D. Baker and A. LaRocque found a nest with four eggs on an island in the Rideau River near Billings' Bridge. After the young had left the nest it was collected for the National Museum on April 26, 1931.

6. *Capella delicata* (Ord.). WILSON'S SNIPE. — On February 19, 1933, Mr. Leslie Stone found and brought to me a Wilson's Snipe, newly dead. He had picked it up under a cedar tree in a springy part of Pine Hill, Rockcliffe Park. The bird, a male, was fat, but had some toes missing. It showed recent punctures of the skin of the head and belly. The frozen toes indicate that this was possibly a wintering bird; the fat condition makes the idea of wintering seem doubtful; perhaps it was an early migrant, and if so its judgment in trusting February weather at Ottawa was poor. Undoubtedly it became the victim of a predatory attack, but escaped the claws that grasped for it, to die in a blood-soaked hidden form in the snow.

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1 *C.F.-N.* 37:101-5, Sept. 1923, 125-7 Oct.; 151-6 Nov.; 38:10-16, Jan., 1924.

2 *C.F.-N.* 39:16-17, Jan., 1925; *C.F.-N.* 46: 123-7, Sept., 1932; 162-6, Oct., 1932.

3 C.F.-N. 48:20-21. Jan., 1934 (Aug. 28, 1933).

4 *C.F.-N.* 46:124, Sept., 1932.

Mr. E. F. G. White recalls that he was told many years ago that Snipe had been found at midwinter in springy parts of a cedar swamp which formerly existed on the south bank of the Rideau River east of Billings' Bridge. This would be at least fifty years ago.

7. *Pisobia minutilla* (Vieillot). LEAST SANDPIPER. — Specimens were taken near Ottawa on the Rideau River on May 14 and 26, 1934, for the National Museum.

8. *Larus delawarensis* (Ord). RING-BILLED GULL. — On November 12, 1934, about noon, E. F. G. White and I went to the small rapids on the Rideau River, (Sparks' rapids), near Strathcona Park to inspect the gulls that were there in some numbers. Among about 24 others was one that was slightly smaller; it had a terminal black band on tail, white upper tail and rump, and dull bluish bill with a black band on frontal part. It was in a mottled gray and brown plumage. We saw it with opera glasses at about sixty feet, and although certain of its identity as a Ring-billed Gull, we went to the Museum and had no difficulty whatever in finding identical specimens in the national collection.

Mr. E. F. G. White considers the earlier record by E. Bedard (one captured and kept alive December 1908, *vide* O.N. 24; 157, Dec. 1910) valid. It is considered that the species may now be removed definitely from the hypothetical section of the Ottawa list.

9. *Xema sabini* (Sabine). SABINE'S GULL. — Mr. E. F. G. White reports that Mr. Hector Bedard shot one near midstream of the Ottawa River, (Ontario-Quebec boundary) in the vicinity of Thurso, Quebec, on September 25, 1933. Mr. White saw the specimen and identified it as a fresh mount, probably late on the same day that it was set up.

10. *Tyto alba pratincola* (Bonaparte). BARN OWL. — C. E. Johnson records[5] the first occurrence of the Barn Owl at Ottawa, being one captured alive late in October, 1933. Master Giffard Johnson deserves credit for first recognizing this novel visitor.

11. *Strix varia varia* (Barton). NORTHERN BARRED OWL. — On February 12, 1934, a wounded Barred Owl was brought to me at my home. It was in a sack, and I put on heavy gloves preparatory to the disagreeable task of putting it out of suffering. The injury seemed to be slight, and much to my surprise the bird was as gentle as a tame parrot. It lived in the cellar for a month, allowed handling without once offering any objection, by beak or claw, and although its diet was mostly beefsteak, it recovered fully and was given its liberty. (March 11th).

At noon on February 26, 1935, a Barred Owl was watched near my residence for some time. He busied himself in dressing his plumage, and in paying close attention to the squirrels, and the birds that were visiting a feeding station, but without molesting them in any way.

12 *Picoides tridactylus bacatus* (Bangs). AMERICAN THREE-TOED WOODPECKER. — One male specimen was taken near the Ottawa Flying Club field, Bowesville Road, for the National Museum, on April 21, 1934. Records of this species are scarce and this is apparently the first spring occurrence.

13. *Perisoreus canadensis canadensis* (Linnæus). CANADA JAY. — One specimen, a female, was collected for the National Museum near Billings' Bridge on November 6, 1933.

14. *Telmatodytes palustris palustris* (Wilson). LONG-BILLED MARSH WREN. — Near Billings' Bridge on the Rideau River, Mr. C. E. Johnson found and collected a nest for the National Museum on August 8, 1934.

15. *Sturnus vulgaris vulgaris* (Linnæus). STARLING. — In 1930-31 this bird was first noted as being generally distributed throughout the City of Ottawa.

16. *Spiza americana* (Gmelin). DICKCISSEL.— One fed with the English Sparrows in Dr. R. E. De Lury's garden for two or three days, was caught and banded on August 26, 1934, and was still there the next day. This was at 330 Fairmont Avenue, which is near the Experimental Farm, the place where the only previous Ottawa Dickcissel spent the summer of 1895.

17. *Pipilo erythrophthalmus erythrophthalmus* (Linnæus). RED-EYED TOWHEE. — A nest, the first for the district, was found by C. H. Young and C. E. Johnson at Constance Bay on June 11, 1933. Both birds were seen. The set, 3 Towhee, 1 Cowbird, and the nest, was collected for the National Museum.

Submitted for publication, 7 May, 1935

5 *C.F.-N.* 48:82, May, 1934.

NOTES ON SOME MAMMALS IN THE BRITISH COLUMBIA PROVINCIAL MUSEUM WITH A LIST OF THE TYPE SPECIMENS OF NORTH AMERICAN RECENT MAMMALS IN THE MUSEUM

By IAN McTAGGART COWAN

A RECENT SURVEY of the mammal collection in the British Columbia Provincial Museum has brought to light certain material which for one reason or another is deemed worthy of special record. This material includes two new records for Canada, and specimens supplementing our information with regard to two little-known races of Vancouver Island mammals. I have appended a list of the three type specimens of North American mammals in the Provincial Museum collections together with some notes on other specimens of these mammals and of their present status.

Sorex palustris brooksi Anderson, VANCOUVER ISLAND WATER SHREW. — The discovery of a specimen of *Sorex palustris* from Vancouver Island in the collection came as a pleasant surprise.

The specimen, No. 985 B. C. Prov. Mus., is an adult male with the flank glands very prominent. It was taken May 1, 1897, in Lake District, Victoria, V.I., B.C., by D. Stevens. This is the second specimen of the Vancouver Island race known to science, the only other specimen, the type, was an adult female.

In colour our specimen agrees well with the description of the type given by Anderson (*Canadian Field-Nat.*, 48:134, 1934). The back and rump are black with the hairs finely tipped with white; the head and shoulders are more of a dusky brownish black and lack the white hair tips. The chin and a small patch on each side of the abdomen below the flank glands are silvery gray; the remainder of the underparts are nearest hair brown of Ridgway, much darker than any specimens of *Sorex palustris* from the adjoining mainland of British Columbia, and yet not quite so dark as in *Sorex bendirei bendirei*. The feet are brownish rather than silvery gray and are conspicuously fimbriated. The tail is brown, very little lighter below except just at the base.

The parietal portion of the cranium is missing. Measurements obtainable from the remaining parts are as follows: Palatal length 9.3 mm.; interorbital breadth 4.0 mm.; maxillary breadth 6.0 mm.; alveolar length of upper tooth row 8.2 mm.; mandibular tooth row excluding first incisor 6.0 mm. Sagittal crest well developed.

Gulo luscus vancouverensis Goldman, VANCOUVER ISLAND WOLVERINE. — At the time the description of this race was published (Goldman, *Proc. Biol. Soc. Wash.* 48, Nov. 15, 1935: 177) the present writer was coincidently investigating the status of the Vancouver Island wolverine. This race was known to the describer by two skulls only, and as the available material in the British Columbia Provincial Museum consists of the skull of an old adult male and the skin and skull of a smaller adult male the following remarks are offered as a supplement to Goldman's description.

External Characters: — In comparison with an adult male and female from Telegraph Creek, B.C., the Vancouver specimen differs in being lighter in colour throughout with noticeably less contrast between the dark dorsal area and the surrounding light patch. While the various shades of brown represented in the fur of a wolverine defy duplication in colour charts, the dark dorsal patch and the legs of our Telegraph Creek specimens are nearest light seal brown of Ridgway (*Color Standards and Nomenclature*, 1912) but are somewhat richer in tone. The surrounding light patch is nearest tawny-olive and the line of demarcation is sharp. In the Vancouver specimen the back, legs, and neck are nearer verona brown and blend more gradually into the light area. The feet, muzzle, and terminal half of the tail are dark brown, almost black. One of the most pronounced features is the light coloured brown patch of the Vancouver Island specimen. Light buff is the predominating colour over the entire crown. This stands in sharp contrast with the mainland specimens in which the crown is largely brown, and only slightly flecked with buff. There are several white patches on the throat and chest.

These distinctions are very apparent in our specimen, however the colours of wolverine are so variable that without the corroborative evidence of further specimens it is not safe to assume these differences to be racially diagnostic.

Skull Character: — As regards cranial characters our specimens fail to substantiate the supposed differences found in Goldman's specimens except as regards the slightly heavier teeth.

In the accompanying table I present measurements of our two males from Vancouver Island and those of the type as given by Goldman (*loc. cit.*). Compared with these are two males from Bella Coola, B.C., on the coast of the adjoining mainland. While there is great disparity in size in both groups No. 1343 from Vancouver Island is of approximately the same age as No. 1411 from the mainland, and No. 1570 approximately the same age as No. 1341. Neglecting individual variation then, as one must perforce in the absence of large series, the differences here apparent can be regarded as of probable geographic significance.

Museum No.	Sex	Locality	Condylobasal length	Zygomatic breadth	Breadth across mastoid processes	Interorbital breadth	Breadth across post-orbital processes	Post-orbital constriction	Palatal constriction	Alveolar length of maxillary tooth row	Crown length of upper carnassial	Diameter of upper canine at alveolus
211499 USNM†	male	Great Central Lake	146.4	104.9	83.9	40.2	48.6	33.7	16.8	50.3	21.4	11.6
1343 BCPM	male	Vancouver Island	144.0	100.0	86.0	39.0	49.0	35.0	17.7	51.0	21.0	11.3
1570 BCPM	male	Cowichan Lake, V.I.	136.4	89.*	79.*	36.4	44.8	32.2	20.4	47.4	19.0	10.0
Average of last two			140.2	94.5	82.5	37.7	46.9	33.6	19.0	49.2	20.0	10.6
Combined average.			142.1	98.0	83.0	38.5	47.5	33.6	18.3	49.6	20.5	11.0
1411 BCPM	male	Bella Coola, B.C.	149.0	106.3	91.4	41.8	49.0	37.0	19.0	51.5	20.5	11.0
1341 BCPM	male	Bella Coola, B.C.	129.0	92.0	77.5	36.4	44.0	32.0	17.7	46.0	18.7	9.8
Average			139.0	99.1	84.4	39.1	46.5	34.5	18.3	46.2	19.6	10.4

*Approximations.
†After Goldman.

Cranially *C. l. vancouverensis* differs from *G. luscus* of the adjoining mainland in having the skull relatively narrower in all parts save width of frontal shield, in which the two races are much the same; the teeth average slightly heavier. I can find no difference in width of palate, width of interpterygoid fossa, audital bullae, or symphysis of the mandibles. There is some indication that the foramen magnum in *vancouverensis* is more rounded, less flattened dorso-ventrally. No. 1343 presents a remarkable development of the sagittal crest, particularly at its posterior end. Here it projects approximately 18 mm. behind the plane of the condyles.

In so far as cranial distinctions are concerned *vancouverensis* is at the best a feebly characterized race, there are however certain external features which if corroborated will tend to substantiate its racial recognition.

Myotis subulatus melanorhinus (Merriam). — This bat, not hitherto recorded from Canada, is represented in the museum collections by twelve specimens, 8 females and 4 males. All were collected at Vaseux Lake and Okanagan Falls, B.C., by E. M. Anderson between April 26, 1913, and May 30, 1913.

I am indebted to William L. Engels of the Museum of Vertebrate Zoology, Berkeley, California, for checking the identification of these specimens in comparison with the series in that museum.

Zalophus californianus (Lesson), CALIFORNIA SEA LION. — There is in the Provincial Museum the perfect, unweathered skull of an adult male California sea lion lacking the teeth and lower jaw. It was stored with a number of skeletons of the Steller sea lion (*Eumetopias jubata*) that were destined for mounting and consequently had not been entered in the museum

catalogue of study specimens. It is now No. 1463 B. C. Prov. Mus.

Though uncatalogued, the skull had written on it time-worn ink "picked up at Claquot now spelled Clayoquot, V.I. B.C., by Capt. Hughes". The Captain W. O. Hughes referred to was a well-known figure in the sealing industry of this coast during the latter part of the 19th century. He commanded first the *Carmélite,* which was seized by the Russians, and later that famous schooner the *Mary Ellen.* His active interest in pelagic sealing extended from 1891 to about 1896. It is probable, therefore, that the skull in question was obtained at some time in that period.

I have been unable to obtain any information as to whether the sealing schooners operating out of San Francisco called in at Clayoquot, a regular port of call for the Victoria fleet. As the specimen is not definitely stated to have been killed at Clayoquot or in the vicinity, there is always the possibility that it was brought from California. In this connection, however, it must be borne in mind that the San Francisco fleet sailed directly north to meet the northern seal herd somewhere off the coast of northern California or southern Oregon, and that *Zalophus* does not normally occur north of Monterey Bay (Grinnell, *Univ. Calif. Publ. Zool.,* 40:117, 1933). It seems further unlikely that men engaged in the arduous business of pelagic sealing and with limited space, should in the first place shoot a bulky, valueless, shore-frequenting sea lion, and even less likely that they would then go to the trouble of saving the skull. While recognizing the hypothetical nature of the record I neverthelesss present this as a possible occurrence of *Zalophus* in Canadian waters.

TYPE SPECIMENS OF MAMMALS IN THE BRITISH COLUMBIA PROVINCIAL MUSEUM.

Rangifer dawsoni Seton-Thompson, QUEEN CHARLOTTE ISLAND CARIBOU. — *Ottawa Naturalist,* 13, No. 11, Feb. 1900:257-261, pls. 4 and 5.

Type: — Adult male, B. C. Prov. Mus. No. 1483, fragmentary skull consisting of cranium to front of orbits and lacking the occipital condyles, basioccipital, maxillae, and entire rostrum; right antler only, left pedical diseased. Taken (?) 1882 by Alex. Mackenzie and presented by Wm. Charles.

Type Locality: — Upland meadow on the west slope of Graham Island, west of Massett. Queen Charlotte Islands, British Columbia.

Remarks: — In addition to the type the museum has the following specimens of this rare caribou:

No. 1484, adult male, skin and ? skull, mounted and on display in dust-proof glass case. Right antler only; taken November 13, 1908, on Graham Island, west of Virago Sound, Q.C.I., B.C. This is the specimen described and figured by Merriam (in, Sheldon, *Wilderness of the North Pacific Coast Islands,* 1913: 233-237). Since this description was published, inevitable exposure to light has faded the specimen to a grayish white with faint tinges of brown on crown and flanks.

No. 1486, adult male, skull only; west side of Virago Sound, Graham Island, Q.C.I. November 13, 1908. Since Merriam (*loc. cit.*) described and figured this skull it has been badly broken. The rostrum and entire maxillary region with the teeth are now missing along with the occiput and both zygomata. Taken by H. White.

No. 1487, skin of young female in good condition; taken by H. White on west side of Virago Sound, Q.C.I., November 13, 1908.

No. 1488, shed left antler, picked up by Commander Hunt and Lieutenant Bills, Feb. 22, 1906, on the uplands on the west side of Virago Sound inland from Hussan Point (see *Ottawa Naturalist,* 19, July 1906:73-76).

As external measurements of this caribou were not given in the previous descriptions the following, as taken from the mounted adult male No. 1484, may be of interest: Total length 1910 mm.; length of tail 110 mm.; hind foot from point of heel to tip of dew claw 385 mm.; height at shoulder 1050 mm.

With regard to the present status of this caribou Henry White, of Massett, the collector of three of the above specimens, in the autumn of 1935 told me that he had, within the past year, seen fresh caribou tracks. He is confident that the species is still to be found on the inland plateaus of northern Graham Island.

Ovis fannini Hornaday FANNIN SHEEP. — Fifth Ann. Rept. New York Zool. Soc., App. No. 1, Jan. 8, 1901:2.

Type: — Adult male, B. C. Prov. Mus. No. 1485, mounted and on display in glass case; taken February, 1900, by H. W. Brown.

Type Locality: — Dawson City, Yukon Territory.

Remarks: — Coming as it does from a region lying between the ranges of *Ovis dalli* Nelson and *Ovis dalli stonei* Allen, the type of

Ovis dalli fannini is very evidently but one phase of the continuously grading series between these two races. As such it does not merit systematic recognition and should be relegated to the synonomy of *Ovis dalli dalli.*

Ursus kermodei Hornaday, KERMODE BEAR.— *Ursus* (*Euarctos*) *americanus kermodei* Hornaday Ninth Ann. Rept New York Zool. Soc. 1904, Jan. 1905:82.

Type: — Young adult female, (permanent canines not yet fully emerged), B. C. Prov. Mus. No. 1369; mounted skin on display in dust-proof case, skull separate. Skull represented by premaxillae with teeth, maxillae back to Pm 4/ on left side, to just posterior to diastema on right side; lower mandibles including entire tooth row on left side and including M /1 on the right side. Taken May, 1904.

Type Locality: — Gribbell Island, B.C., lat. 53° 25′ north, long. 129° west.

Remarks: — In addition to the type, there are six other white specimens of this bear in the museum, all from Gribbell Island and Princess Royal Island, B.C. To date no attempt has been made to secure specimens of the more abundant black phase from the same region. When such are obtained it will doubtless be found that white colour is not a diagnostic character of the race *kermodei,* the name being equally applicable to the black specimens. What cranial material there is available indicates a wide range of individual variation. Adult ? male No. 1367 is a long low, narrow skull, with the high point well back over the brain case. The only other adult skull, male No. 1370 has a short thick rostrum and a high frontal region, approaching *Ursus americanus altifrontalis* in general conformation of these parts. Specimens of black bear from Namu and Bella Coola, B.C., are typical *altifrontalis.*

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A SLUG NEW TO THE QUEBEC AND OTTAWA LISTS

By A. LA ROCQUE

IN COMPARING alcoholic material from the Ottawa District with living specimens of *Arion circumscriptus* (Johnston) received lately from Toronto, the writer found three specimens of this species collected at different points around Ottawa. The three localities are as follows: Val Tetreau, a suburb of Hull, Quebec, 1 specimen. Meach Lake, Quebec, 1 specimen. Brantwood Beach, Rideau River, Ottawa, 1 specimen.

The species has been recorded for Toronto, where it has become thoroughly naturalized, for many points in Maine and for Charlottetown, P.E.I., but so far not from any point in the province of Quebec, or in the Ottawa district. These records may not give a true picture of the distribution of the species, as slugs are so generally neglected by collectors.

That the species is well established in the Ottawa district is indicated by the distance between the above records, Meach Lake being about twenty miles north of Ottawa, and the Val Tetreau and Brantwood Beach records being separated by some four miles and the Ottawa River.

The species is generally understood to be an accidental introduction from Europe. In the Ottawa district it may have been introduced from some of the other points in Canada where it is known to thrive, or may have spread northwards from Toronto.

It is probable that its introduction in the Ottawa district is relatively recent since the active collectors who worked in the district some thirty and forty years ago and were known to collect in at least the first two localities where these specimens were found, could not have missed such comparatively large animals.

CHRISTMAS BIRD CENSUS

The Bird Census Committee wishes to remind any interested readers to take a Christmas Bird Census on some day between December 20 and 28, and send a report of it to the Editor as promptly as possible. For the kind of report desired, please see published reports of previous years and discussion in The Canadian Field-Naturalist for September, 1933, pages 112-116.

A PRELIMINARY LIST OF THE BIRDS OF LINCOLN AND WELLAND COUNTIES

By R. W. SHEPPARD, W. E. HURLBURT and G. H. DICKSON

(*Concluded from page* 140)

Wilsonia canadensis (Linnaeus). CANADA WARBLER. — This would appear to be a somewhat uncommon visitor, for we have only five spring records from Vineland and one or two from Niagara Falls but, owing to its habit of travelling through the lower growths and underbrush and the fact that on this account it might easily be overlooked, it is quite possible that it is a more regular migrant through this area than our records would indicate. Laing[43] at Beamsville in 1918 observed a family party on September 8th.

Setophaga ruticilla (Linnaeus). AMERICAN REDSTART. — Although more numerous as a passing migrant, the Redstart is not uncommon as a summer resident in Welland County, where a few pairs may be found in nearly all of the larger wood-lots. Formerly nested on the wooded slopes at the back of Queen Victoria Park near Niagara Falls; but recent thinning of timber, building, and landscape alterations have now, apparently, caused these birds to desert this breeding area for larger and more secluded woodlands. As a breeding bird this warbler does not appear to be so frequently met with in Lincoln County but records of a few pairs seen a short distance south of Vineland during the summer of 1927 and 1932 would serve to indicate that it breeds, at least sparingly, in this locality. In the immediate vicinity of Vineland this bird is frequently observed during the spring migration season.

Passer domesticus domesticus (Linnæus). ENGLISH SPARROW. — A very abundant resident throughout the area. In the rural sections this ubiquitous species does not appear to vary much in numbers from year to year but in the larger towns and cities some slight decrease in numbers has been noticed during the last ten years.

Dolichonyx oryzivorus (Linnæus). BOBOLINK. — A fairly common summer resident throughout both counties, nesting wherever suitable meadow lands are to be found. Believed to be slowly increasing as a breeding bird in some parts of Welland County. In the autumn large flocks of this interesting bird are frequently seen in the Jordan marshes, near Vineland.

Sturnella magna magna (Linnæus). EASTERN MEADOWLARK. — A common summer resident, usually arriving toward the end of March or early in April and departing in late September. A nest containing four Meadowlark's and one Cowbird's egg was found near the Niagara Glen by the senior author in May, 1934. Apparently, odd birds occasionally remain throughout the winter, for individuals of this species have been seen on one or two occasions during the mid-winter months.

Agelaius phoeniceus phoeniceus (Linnæus). EASTERN RED-WING. — A very common summer resident, arriving in March, sometimes as early as the first week of that month. In both Welland and Lincoln Counties nearly every reed-bed, however small, affords a nesting site for at least one pair of these handsome birds. In the autumn they may be seen in both large and small flocks, frequenting the pastures and stubble fields and occasionally associating with the European Starling in a mixed flock, containing almost equal numbers of both species.

Icterus spurius (Linnæus). ORCHARD ORIOLE. — The Orchard Oriole appears to be a regular but very local summer resident, having been observed for the past three years in succession in the Vineland area, where a few pairs are known to nest near the Horticultural Experiment Station. A pair were observed by G. J. Clout near Port Weller in Lincoln County on May 26, 1935.

Icterus galbula (Linnæus). BALTIMORE ORIOLE. — This beautiful bird is a common summer resident throughout both counties hanging its cleverly-constructed nest from the tips of the drooping boughs of the taller elms and maples in the older residential sections of the cities of Niagara Falls, St. Catharines and Welland, as well as in towns and villages and along the highways. Some of the fruit growers and gardeners of the Niagara district accuse this bird of attacking fruit and vegetables such as cherries and green peas but, while admitting that the growers may have some justification for their complaints, such observations as we have been able to make incline us to the belief that the comparatively small amount of damage occasioned to fruit and vegetables is far outweighed by the large numbers of noxious caterpillars destroyed.

43. *Can. Field-Nat.* 34: 25, 1920.

Euphagus carolinus (Muller). RUSTY BLACKBIRD. — In some years this species appears in fairly large flocks, both during the spring and autumn migration, but in other years only odd birds are seen. On October 9, 1933, numbers of these birds were seen by the senior author in the fields near Thorold, associaing with Starlings, Red-winged Blackbirds, Grackles, and Cowbirds in an immense mixed flock, several thousand strong.

Quiscalus quiscula aeneus Ridgway. BRONZED GRACKLE. — The Bronzed Grackle is still a common summer resident, usually arriving in the district about the same time as the Robin; but we have noticed of late years, especially in the vicinity of Niagara Falls, where this species was formerly very abundant, a most remarkable and rapid decrease in the number of breeding birds. This decrease of nesting birds would appear to be a more or less local condition, for no such rapid decline in numbers appears to have taken place in Vineland. In the city of Niagara Falls Grackles sometimes congregate in large flocks in the late summer or early autumn and formerly caused much annoyance, as the Starlings do now, to the residents of certain streets, by roosting in great numbers in the tall shade trees and littering the sidewalks and lawns with their innumerable droppings. On September 18, 1930, a flock of Grackles, containing a hundred or more individuals, was observed near the Niagara Glen feeding voraciously on the acorns of a small group of tall chestnut oaks (*Quercus muhlenbergi*), the dropped fragments of acorn pattering down through the leaves like rain as the birds fed.

Molothrus ater ater (Boddært). EASTERN COWBIRD. — A common summer resident, usually arriving early in April. In September large flocks congregate in the marshes in company with Red-winged Blackbirds and European Starlings. Cowbirds are occasionally found in mid-winter associating with House Sparrows, and in this connection we have a January record from Vineland and a December record from Niagara Falls.

Piranga erythromelas Vieillot. SCARLET TANAGER. — A regular spring migrant, usually passing through the Niagara Falls area about the end of May but not common in that locality, although it is reported to breed on the Queenston heights. In the Vineland area this beautiful species is occasionally quite numerous during the spring migration. It has been observed on the return migration, at Niagara Falls, as late as October 9th.

Richmondena cardinalis cardinalis (Linnæus). EASTERN CARDINAL. — Although apparently extending its range and slowly moving into the area from the west, the Cardinal cannot be considered anything but a rare bird at the eastern end of the Niagara Peninsula. We have no records from the immediate vicinity of Niagara Falls, but it has been reported about seven times from the Vineland district during the past five years. G. J. Clout has recently found this bird breeding at Port Colborne in Welland County, and in this connection he has told us of seeing a pair with three young on the wing, on July 31, 1935 and of his discovery of another pair with a nest containing three nestling young, on August 1, 1935. The vicinity of the Lake Erie shore line of Welland County has apparently been a local stronghold of this interesting bird for a number of years, for members of the Buffalo Ornithological Society have frequently reported it from this area and as long ago as the year 1909 David E. Wheeler[44] recorded his observation of a pair on the Canadian shore of Lake Erie about six miles from the city of Buffalo.

Hedymeles ludovicianus (Linnæus). ROSE-BREASTED GROSBEAK. — A regular and quite common spring migrant in the Vineland district, usually arriving about the middle of May or earlier. Although it has been observed only on migration, it is suspected that some pairs may remain to breed in the more secluded areas of Lincoln County. Apparently a somewhat rare bird in the immediate vicinity of Niagara Falls for, with the exception of an odd bird or two seen on migration, we have few if any personal records of its occurrence at this point.

Passerina cyanea (Linnæus). INDIGO BUNTING. — Not an uncommon summer resident in the Vineland area, where it has been found to favour shrubby hillsides, and to show some partiality for nesting among raspberry bushes. Occasionally seen near Niagara Falls, but not commonly.

Hesperiphona vespertina vespertina (Cooper). EASTERN EVENING GROSBEAK. — A somewhat rare visitor to this district. In the winter of 1930 a flock of seven individuals spent about a month among some Manitoba maples at Vineland and in that same locality, during the latter part of 1933, the aviaries of Dr. W. E. Hurlburt, containing at the time some captive birds of this species, were visited by a male Grosbeak on November 3rd and by two females on December 1st. Otomar Reinecke[45] has reported the oc-

44. *Bird-Lore*, 12: 80, 1910.
45. *Oologist*, 28: 58-9, 1911, and 29: 355-6, 1912.

currence in winter of flocks of this species at Sherkston, Ridgeway and Niagara Falls between the years 1889 and 1911.

Carpodacus purpureus purpureus Gmelin. EASTERN PURPLE FINCH. — Occasionally seen during the spring months, both at Niagara Falls and at Vineland but it does not appear to be at all common in either locality. The Purple Finch has, on occasion, been observed at Vineland during winter and G. J. Clout has told us of his observation of a flock of about twenty near St. Catharines, on March 10, 1936.

Acanthis linaria linaria (Linnæus). COMMON REDPOLL.—A bird of sporadic occurrence. Large flocks have been occasionally observed, during the late winter and early spring months, at Niagara Falls and Fonthill in Welland County, while it has been reported on several occasions from Vineland and other Lincoln County points in midwinter. The lighter coloured, pale greyish birds occasionally encountered among the winter flocks of Redpolls in this area are possibly referable to the Hoary Redpoll *Acanthis hornemanni exilipes,* but in the absence of collected specimens we are unable to produce any definite evidence to this effect.

Spinus pinus pinus (Wilson). NORTHERN PINE SISKIN. — An irregular visitor, it has been observed only in winter time at Niagara Falls but at Vineland five separate observations of this little finch have been made during the months of April and May. At that time it appeared to resemble the Goldfinch in its habits, inasmuch as it frequented lawns and fed upon the seeds of Dandelion, etc.

Spinus tristis tristis (Linnæus) EASTERN GOLDFINCH. — A very common summer resident throughout both counties, usually becoming exceedingly abundant in September and early October, when the family parties commence to wander over the country side. This beautiful little bird appears to be subject to a fluctuation in numbers or a periodicity, which makes it noticeably abundant in some years and comparatively scarce in others. Following several years of apparent normality it was present in most unusual quantities in this district during the years 1931 and 1932. We are of the opinion that a careful study of the Goldfinch, with frequent census taking in a given area over a number of years, combined with observations on weed conditions and the influence of weather on seed formation, would produce some very interesting results and would probably help very materially toward an explanation of the apparent fluctuation in the numbers of this exceedingly useful and very charming little bird.

Loxia curvirostra pusilla Gloger. RED CROSSBILL. — A scarce winter visitor. The latest record for the Vineland area was in March, 1932, when a flock of fourteen spent about a week in that vicinity. Seven, or exactly half of the birds in this flock, were in the red plumage and the other seven were green. They were quite tame and spent a great deal of time eating the seeds out of some old sunflower heads which had been left standing.

Pipilo erythrophthalmus erythrophthalmus (Linnæus). RED-EYED TOWHEE. — Seen regularly as a spring migrant in the Vineland district and occasionally at Niagara Falls. This bird is also found somewhat sparingly during the summer months as a nesting species within the more heavily wooded sections of the two counties. G. J. Clout found a nest with four nestling young near St. Catharines on June 1, 1935, and fifteen or more years ago Laing[46] wrote of it as breeding locally near Beamsville.

Passerculus sandwichensis savanna (Wilson). EASTERN SAVANNAH SPARROW. — A common summer resident of the pasture fields, usually arriving about the middle of April or earlier.

Ammodramus savannarum australis Maynard. EASTERN GRASSHOPPER SPARROW. — Apparently a somewhat uncommon species at the eastern end of the Niagara Peninsula. This small and unobtrusive sparrow was observed by the senior author in Welland County on one or two occasions during June, 1934, and more recently, in the summer of 1935, it has been found to occur sparingly in the rough pastures near Warner in Lincoln County.

Passerherbulus henslowi henslowi (Audubon). WESTERN HENSLOW'S SPARROW. — We have no personal records of this sparrow within the area of Lincoln and Welland Counties but it is perhaps of special interest to mention here J. Murray Speir's[47] recent report of its occurrence at Lowbanks on the Welland and Haldimand County borders.

Poöecetes gramineus gramineus (Gmelin). EASTERN VESPER SPARROW. — A very common summer bird of the roadside and pastures. Sometimes abundant, especially in the southern part of Welland County, where it often remains until as late as the middle of October.

Junco hyemalis hyemalis (Linnæus). SLATE-COLOURED JUNCO.—A common and regular winter visitor, usually appearing late in October or early in November, although, occasionally, as early as September. In some seasons only comparatively few spend the entire winter in

46. *Can. Field-Nat.* 34: 24, 1920.
47. *Can. Field-Nat.* 47: 35, 1933.

this district but when this happens they are frequently almost abundant during the month of April, as the birds that went farther south begin to drift northward again. The Junco is a frequent visitor to gardens and vacant lots in and around the city of Niagara Falls during the late autumn and early spring months.

Spizella arborea arborea (Wilson). EASTERN TREE SPARROW. — This is a common winter bird throughout both counties. Usually to be found at the edge of old rough pastures, gardens, orchards, graperies, or wherever tall weed growths are to be found in combination with some adjacent shelter, such as evergreen windbreaks or small patches of wooded land.

Spizella passerina passerina (Bechstein). EASTERN CHIPPING SPARROW. — This familiar little sparrow is a very common summer resident throughout the area, generally arriving during the latter part of April and occasionally lingering until October.

Spizella pusilla pusilla (Wilson). EASTERN FIELD SPARROW. — A common but somewhat local summer resident favouring hillsides and rough pasture lands chiefly in the southern or higher parts of Lincoln County. We have no personal records from Welland County, but it is presumed to be present there in suitable localities.

Zonotrichia leucophrys leucophrys (Forster). WHITE-CROWNED SPARROW. — This handsome sparrow is quite commonly observed during both spring and autumn migration periods. At Vineland it would appear to be most frequently noted in the spring but in the vicinity of Niagara Falls we have more often observed this bird during the autumn movement, about the end of September or early in October.

Zonotrichia albicollis (Gmelin). WHITE-THROATED SPARROW. — A common spring and autumn migrant, both at Vineland and at Niagara Falls. Here, in this southern part of Ontario, we are not often favoured with the truly beautiful song of this bird but on September 30, 1932, we were privileged to hear a chorus of several, singing in a large brush-covered depression, containing thorn trees and high weeds, close to the outskirts of the city of Niagara Falls. These particular birds were associating and appeared to be travelling in company with a few White-crowned Sparrows, one of which was also singing within a few yards of the observer, one or more Juncos, a number of Robins, and some unidentified warblers.

Passerella iliaca iliaca (Merrem). EASTERN FOX SPARROW. — This large, handsome sparrow is not uncommon in the vicinity of Vineland during the spring migration season. Here it is usually to be seen soon after the middle of April and at that time it may quite frequently be found scratching among dead leaves on the Horticultural Experiment Station grounds. We have one winter record, from Vineland, of a single example observed on January 31, 1928. This bird was seen in an apple orchard, in company with Tree Sparrows but pursuing its own method of feeding by scratching vigorously at the foot of the trees.

Melospiza georgiana (Latham). SWAMP SPARROW. — We have very few definite records of this bird but it has been seen on one or two occasions in the vicinity of Vineland and at least once near Niagara Falls. More field work and closer observations of the marshy areas would in all probability reveal this bird as a species which is much less rare than our few personal records would tend to indicate.

Melospiza melodia melodia (Wilson). EASTERN SONG SPARROW. — This is undoubtedly the commonest and most widely distributed native sparrow within the two counties. It is present throughout the year, for it is quite frequently seen in sheltered spots during the winter months, especially in the vicinity of water, but, commencing early in March, the small numbers of the overwintering birds are greatly augmented by a very considerable influx of migrants from the south.

Calcarius lapponicus lapponicus (Linnæus). LAPLAND LONGSPUR. — A somewhat rare visitor, chiefly of the late winter or early spring months. Our few notes on this species record only the infrequent occurrence of odd birds at Niagara Falls, St. Catharines, and Vineland, but from the latter point Douglas Ross has given us a report of his observation on March 17, 1934, of a large flock of Lapland Longspurs which he estimated to contain from 400 to 500 birds. There is an interesting autumn record by Laing[48] of three seen passing overhead at Beamsville in Lincoln County on November 9, 1918.

Plectrophenax nivalis nivalis (Linnæus). EASTERN SNOW BUNTING. — The Snowflake, as this bird is frequently called, is an irregular but sometimes abundant winter visitor to both Lincoln and Welland Counties. Few winters go by without at least a few of these buntings being seen; but, in general, it is only when the weather is severe and the snow quite deep that we are favoured by the visit of a really large flock of these beautiful birds from the north.

48. *Can. Field-Nat.* 34: 24, 1920.

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